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REVIEW OF EDUCATIONAL RESEARCH

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Vol. XV, No. 1

February 1945

School Plant and Equipment

Reviews the literature for the three-year period since the issuance of Volume XII, No. 2, April 1942.

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Vol. XV, No. 2

April 1945

Counseling, Guidance, and Personnel Work

Reviews the literature for the three years ending October 1, 1944. Earlier literature was reviewed in Volume III, No. 3; Volume VI, No. 2; Volume IX, No. 2; and Volume XII, No. 1.

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Vol. XV, No. 3

June 1945

General Aspects of Instruction: Learning, Teaching, and the Curriculum

Reviews the literature for the three-year period since the issuance of Volume XII, No. 3, June 1942.

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December 1945

Methods of Research and Appraisal in Education

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FOREWORD

THE VALUE OF THIS ISSUE of the REVIEW may be inversely proportional to the amount of research conducted in this field during the past three years. For more than four years school building construction has been nearly at a standstill in the United States. There is some evidence that the need for new construction is accelerated with each year the war continues. When the war ends, there will be such a backlog of need for new school building as has not been witnessed in any previous period in the history of American education.

The contributors to this issue of the REVIEW make it clear that we cannot be satisfied with the kind of school building we have heretofore accepted, good as much of it was. New buildings must be adapted to the changing purposes and methods of instruction. They must be centers for fostering human relationships and social intercourse not only of children but of persons of all ages. Research suggests new standards for ventilating, lighting, heating, materials, and design.

More than in most issues of the REVIEW the Committee on School Plant and Equipment has stressed the research that is needed if the great volume of school building construction needed after the war is adequately to serve the ongoing progress of education.

J. CAYCE MORRISON

Chairman of the Editorial Board

INTRODUCTION

THIS IS THE FIFTH NUMBER of the REVIEW OF EDUCATIONAL RESEARCH dealing with the school plant and equipment. The four previous numbers covering this area were published in December 1932, October 1935, October 1938, and April 1942.

This volume has been prepared thru the overtime efforts of contributors who were already heavily loaded with additional wartime responsibilities. Curtailment in building activity has greatly reduced the volume of research in this field, altho extensive research and planning preparatory to a postwar school building program should be under way.

The Committee has included in this number many authoritative articles by experienced school plant specialists, because it is believed they are as significant for the guidance of school administrators and architects as much of the more objective research by less experienced authors.

In general the Committee has followed the organization of the four previous numbers in the school plant series but it seemed advisable to make a few changes. This number includes a chapter on "Plant Facilities for Higher Education," covering the period since the 1938 number. "School Plant Insurance" has in the past been treated under various chapters in the different series of the REVIEW. The Committee considers that this is a school plant topic and has given it a chapter in this number. The field of pupil transportation has been treated in some of the earlier school plant numbers, but that topic was omitted from this number because it was covered in the April 1944 number on "Finance and Business Administration." Because of present emphasis on vocational education and audio-visual aids, the Committee has devoted a chapter in this number to each of these topics. This number was originally planned for division into six major parts but the final materials did not seem to fit logically into such an organization.

RAY L. HAMON, *Chairman*

Committee on School Plant and Equipment

CHAPTER I

Social Significance of the School Plant

JOSEPH SEIDLIN

WE HAVE TRAVELED a long way from the somewhat mythical and wholly sentimental "log" that was the school plant for Mark Hopkins and his more or less fortunate pupil; but not until very recently have any significant attempts been made to provide the right kind of "mansion" of education for society's ever-expanding "house." It seems altogether likely that a high correlation exists between the character of the school plant and the all-round usefulness of the school plant to the community.

An increasing number of studies, ranging from the armchair variety to a few that bear some semblance to scientific investigation, are concerned with suggesting or determining those characteristics of a school plant which are most likely to make it at once the most efficient schoolhouse and the most effective community center.

It does seem, however, that the early stages of pioneering in whatever has thus far passed for research in this area are over. It is time that workers in the field and researchers in the neighboring fields were made aware of the meaning of research in school plants and equipment.

It does not matter a great deal how social scientists define research (save, perhaps, in some way that least offends the physical scientists). so there cease to be many unwarranted claims to scientific validity of pseudoscientific or nonscientific "studies" and much apologizing on the part of reviewers. In many of the former issues of the REVIEW one finds the expression "actual research." Since one does not know what is meant by research, "actual" helps matters not at all. Social progress may or may not depend on research, experimentation, or a scientific attitude. There are those "in high places" who believe that a Sinclair Lewis, passing thru Main Street of Middletown at twenty-five miles per hour, is capable of learning and telling as much about "life" in Middletown as a heavily staffed research group after two years of hyperscientific study. Even if this were so, some kind of research would be needed to separate the Sinclair Lewises from those who pose as or pass for Sinclair Lewises.

The bibliography for this chapter includes a variety of published material which bears on the social significance of the school plant. Most of the material is suggestive of and excellent preparation for an approaching period of controlled experimentation and research.

The School Plant Covers More Ground

The phase of "sufficient school plant acreage for playgrounds" has been passed. That much has been generally accepted and is determined by law in some states. It is a long step ahead claimed by Engelhardt (5) that "in the high schools, part of the instruction of every youth will be

lessons in automobile driving for which driving grounds will be needed. The high schools may be expected to give flying training in low-powered planes—for this alone a minimum of 320 acres is essential. . . .” To obviate the criticism of impracticality, Engelhardt (7) elsewhere suggested that “the future school plant may be widely scattered, the camp in the mountains, the ship at the shore, the airport, and the farm at the outskirts.”

The School Buildings to Serve More and More Varied Purposes

Leevy (12) suggested that the utility of high schools, even in small communities, may be expanded to include adult educational meetings, the scheduling of school events in cooperation with interest groups, and the sharing of the school library with the public. In this connection, Engelhardt (6) warned boards of education especially that new building programs dare not neglect “the impact of this war upon the educational needs of our people.” Seman (19) declared that the school buildings of the future will need to be the “beacon of the Community . . . the center in which the real needs of the people will be met.” Several such or nearly such model schools are already in existence. Powell (17) found that such schools, as the Henry E. Huntington School of San Marino, California, serve at once as “town hall, lecture room, little theater, music hall, community dance pavilion, library, boy or girl scout cabin, and, more recently, war-work center.” More moderately, Moehlman (15) claimed that the physical facilities for youth and adult educational activities “tend to supplement each other to such an astonishing degree that the provision for dual facilities within the secondary plant should not be considered either difficult or expensive.” Finally, Lescaze (13) contended that the realization that generally “our school buildings are inferior to our educational programs” will spur us on to better planned and better designed school buildings.

Availability of School Plants for General Community Uses

West (21) gave a detailed description of the rules and regulations governing the use of school buildings for community purposes in Long Branch, New Jersey. It would appear to be the most extensive use of the school plant on record. Chambers (2) analyzed the problem of using school property for extra school (community, civic, and recreational) uses as still “lively” and productive of disagreements and court actions. In the case of the Detroit schools (18) the use of school buildings was established on a basis of cooperation between the board of education and the department of parks and recreation. Based on an earlier survey, Grieder (8) reported “no conflict between community and school use of the school plant.” In fact, in the state of Colorado there is “a complete absence in the school laws of any regulative measures pertaining to school building use.” The National Recreation Association (16) in cooperation with the American Association of School Administrators issued a leaflet outlining basic plans

and offering suggestions for the use of school buildings for community recreation.

Community Centered Schools and School Centered Communities

Hecht (10) found that generally our schools are not "being used to the full measure of their capacity." He recommended investigation of the possible kinds of interaction between the school and the community. Moehlman (15) emphasized that the community centered school offers the the best opportunity for the people to exercise their fundamental right to participate as partners. . . . Hanson (9) recommended that school buildings should be built where the children are and with an understanding of "educational function." Clark (3) in a summary of a group of experiments on school centered communities concluded that ". . . within the limits of our Experimental Evidence the schools can change a Community."

Children Live As Well As Learn in School Buildings

Mock (14) stressed the planning of school buildings from the point of view of the children who will use them. There must be established "a sympathetic relationship between buildings and children." In much the same vein Holmes and Shigley (11) emphasized that the school plant "molds our children's tastes and opinions." Washburne (20) described the Crow Island School in Winnetka as a building planned by "the coordinated thinking of children, teachers, supervisors. . . ." The building is not "too beautiful"; it is, in short, for children's use. The extreme of building use by children was demonstrated by Kaiser's Child Service Centers serving the Portland shipyards (1). These might not survive the war. Dotter (4) developed a score card for school plants in which he regards site, building, classrooms, special classrooms, general service rooms, administrative rooms, and service systems as the seven major factors. The total number of subdivisions is fifty-one, and in all, a list of over 1300 factors was developed.

Needed Research

There is a clear-cut trend in both thought and observation, as well as some incomplete experimentation, toward further inquiry and research in the following two areas of school-community interrelationship:

1. What are the limits of the differential between the nature and the quality of the school plant and the nature and the quality of the community homes for maximal influence of the school plant on the tastes, desires, and "behavior" of the community?
2. How may parents (and nonparent taxpayers) be made to feel that the school plant belongs to them? And, reciprocally, how may the staff of the school plant be made to feel that the community at large is the enlarged population of the school plant?

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CHAPTER II

Procedures for Determining School Plant Needs

WILLIAM K. WILSON

THE ONLY REASON for the existence of a school building is that it is needed to house an educational program. The determination of need for school plant facilities is a local educational problem, whether the area referred to as "local" is the small rural district or the large city system. The problem of determining school plant needs on the local level may be simple or complex, requiring in the latter case careful and objective survey work that in some details may involve considerable research.

The school plant survey or long-range school plant planning study is concerned primarily with the problem of determining what new buildings are or will be needed, what old ones should be remodeled and continued in use, which ones should be continued as they are, and which ones should be abandoned. These questions are related very closely to enrolment trends, both numerical and locational; to population trends; to conditions of the local school plant; and to educational organization and administration. The need for research is involved in the accurate and reliable prediction of population and enrolment trends as they affect the determination of school plant needs. Detailed planning and financing, while a part of the complete school plant survey, are not specifically part of the problem of determining needs, but they are involved in the problem of meeting the needs as determined.

Three school plant surveys are listed that illustrate technics of research used in determining school plant needs on the local level. In the Minneapolis School Survey, Holy (3) studied the location of all seventh-, eighth-, and ninth-grade pupils in relation to the junior high-school buildings and made recommendations toward the transfer of certain pupils from elementary buildings to junior high schools. Holy also determined objectively, thru an area study of the distribution of elementary children, that of eighty-five elementary schools in the city, twenty-one, including two portables, could be closed without denying any child a good school within reasonable walking distance. Engelhardt (1) in the Sewanhaka, New York, high-school district survey based his recommendations for ultimate high-school needs upon (a) analyses of elementary- and high-school enrolment trends, (b) trends in home building and an estimate of the number of homes in the area after the saturation point in building is reached, and (c) the establishment of a ratio of pupils to homes, which ratio predicts the total possible pupil population in the area after it is completely built up. Wilson (8) in the Reading, Massachusetts, school plant survey arrived at his recommendations for a long-range school plant planning program thru the analysis of enrolment and population trends, the establishment of a ratio

between population and *elementary* enrolment, and the determination of ratio for prediction of elementary enrolment (Grades I-VI) to secondary enrolment (Grades VII-XII).

The problem of determining school plant needs on the state and federal level is quite different from that of the local level. On these broader levels the primary purpose of school plant studies almost invariably is to set up an estimate on the total amount of money necessary to bring the total school plant needs of state or nation up to a recommended standard of excellence or efficiency.

No recent research studies on determining school plant needs on the state level have been reported, but several attempts have been made to determine total school plant needs on a nationwide basis. Some studies have developed estimates on the basis of classrooms needed, some on the basis of children for whom facilities are needed, and some on the basis of the money needed to provide adequate school housing facilities. The Research Division of the National Education Association reported (5) that in 1941, 1214 school districts had urgent need for additional school housing facilities for 120,439 children, while in 1942 these same districts urgently required school housing facilities for 123,067 children, an increase of 2.2 percent. The U. S. Office of Education (7) reported from questionnaires returned from 736 counties and 650 cities in thirty-six states, that a total of 5206 new buildings and additions were needed in those districts of which 2597, or approximately 50 percent, were elementary buildings, and the remainder were distributed among various types of schools.

On a qualitative rather than a quantitative approach to the question of nationwide postwar school housing needs, the Research Division of the NEA (4) set up recommendations for the specific types of facilities needed for elementary- and high-school buildings, the size of school grounds, the optimum capacity of buildings of various types, and the instructional equipment that should be provided. On the basis of money needed for nationwide school plant improvement, Fowlkes (2) estimated that five billion dollars would be needed to construct new buildings and repair old ones, while the National Resources Planning Board (6) concluded that nine billion dollars would be needed over a period of five years (1.86 billions annually) to "eliminate deficiencies in school building facilities for pre-school, elementary school, and high school pupils."

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CHAPTER III

The School Plant As an Educational Instrument

CHARLES W. BURSCH

THE CONCEPT OF FUNCTIONAL PLANNING of school buildings has grown and expanded with use. Not many years ago the term applied largely to the effort to have proportionately more of the total area and cost of a school building devoted to educational and service areas, and consequently a less proportion to architectural features designed to produce monumental structures. Furthermore, under that concept school sites are located, arranged, and sized for educational service rather than for the satisfaction of community pride. School plants developed in the past two decades reflect commendably that definition of functional planning.

There is growing evidence, however, that this concept of functional planning of the school plant is being expanded to include consideration of it more specifically as an educational instrument. The best evidence of such emphasis is that teachers, supervisors, principals, and school architects challenge the adequacy of "standard" or traditional facilities for meeting the demands made upon them by modern curriculums content, methodology, and educational and social objectives. This may mean that school planners and teachers no longer will be satisfied with the evaluation of a school plant largely as an adequate and economical space and shelter for pupils and teachers while educational growth and development occurs. They will, in addition, expect that every possible opportunity will be realized to have the physical plant contribute positively to the approved educational process and to the desired enrichment of the educational offering in schools.

This chapter will review the recent emphasis in educational research and literature on the desirability of securing, in school plants, optimum conditions for growth and development of pupils.

Elementary Schools

Sands (6) described the situation thus: "During the last fifty years, the concepts of the elementary curriculum and the teaching process have changed to such an extent that a school environment consisting of the formalized, poorly-equipped, four-walled school room is no longer sufficient. . . . Modern teaching method requires that the teacher be equipped with sufficient physical materials and spacial facilities to encourage wholesome uncrowded living in the school environment. . . . The environment itself should facilitate the development of the child. . . . Every major aspect of the modern elementary curriculum calls for special provisions in the school plant."

Sears (6:15, 22) writes "The present trend is for the school plant to become a highly specialized part of the instructional equipment of the

school." and "If we can add the architect's knowledge, his art, his imagination to the knowledge, art, and imagination of teachers who can build a school in these new terms then we shall get a school home that is not only a shelter but also a vital instrument of instruction and of social progress in its community."

Long (14) after studying twenty school plants housing progressive schools and analyzing the judgments of 289 elementary teachers, principals, and supervisors regarding the desirability of certain physical facilities for an activity program, concluded: "Elementary school plant facilities have always lagged behind the demands of the curriculum. . . . Progress is being made but few school plants have been conceived as yet which adequately meet the needs of the more progressive type of elementary school program. This program is dynamic, while the physical facilities tend to become standardized and thus remain static." Long also listed the inadequacies of the twenty plants studied and described desirable facilities for an activity program.

Englehardt and associates (10) presented a cross section of planning of elementary classrooms as they have been designed thruout the nation. It is their view that: "If education in a democracy is to advance, reasonable freedom must be allowed the local communities . . . in devising the school building spaces which will most definitely further the aims upon which the locality and its professional educational workers have agreed. . . . Not only will safety, sanitation, good lighting, and student and teacher comfort be used as criteria, but human relationships and the learning processes themselves will play greater roles in future planning." Their check list of basic considerations for use in planning an elementary-school classroom represents a wholesome and forward-looking additional procedure to that of using the traditional check lists of standard practices and items. Planning procedures are given an important role in securing more useful buildings.

Hoooper (12) emphasized children's need of space in which to grow as contrasted to having every last detail planned into the school by educators and architects and having the building too splendid to be marred by their normal activities. Bursch (5) found well-understood cooperative planning procedures undertaken by competent persons more important than standards in producing elementary classrooms that would implement educational procedures. Misner (15) described current trends in three areas of education: (a) organization and administration, (b) curriculum practices, and (c) school and community relationships, and discussed the school facilities needed to accomplish them. Hamon (11) discussed the elementary-school plant of tomorrow in terms of wider school and community use and more adequate space for pupil activity. Engelhardt (9) selected and illustrated some of America's best elementary schoolrooms.

Secondary Schools

Wade (19) assumed that each element of a school plant exercises some influence upon every pupil and prepared an extensive scale to measure

the secondary school as a part of the pupil's environment. Altho built thoroly and painstakingly, this scale may have but small value in the school plant field inasmuch as the warning is given not to use it in selecting items to be added to schools. However, as a beginning in definite research for examining the correlation between certain plant provisions and the total educational merit of a school, this study has real significance.

The General Education Board made a grant for a three-year project exploring in five cities the services that art museums can render to secondary schools. Munro (16) in a chapter on conclusions and recommendations stated: "One of the most insistent notes in the reports from all five cities was the call for better facilities, in school buildings, for the exhibition and study of visual materials. . . . The precise nature of these facilities cannot be recommended without much more experimental investigation. . . . But at least we can be sure that school architects will be asked to confer more carefully with art teachers and others responsible for the exhibit program, before crystallizing their plans for new buildings."

Pierce and Hunter (17) portrayed a situation where facilities were provided and arranged to meet carefully determined educational objectives and instructional procedures. Dolloff and others (8) described in detail the construction and use of facilities for a completely individualized but correlated instruction in the sciences and arts. Flexibility, accessibility, and visibility for supervision are the characteristics most stressed. How a proposed liberalized and enriched program of secondary education can be freed from the limitations placed upon it by traditional high-school plants was considered by Bursch (4).

Studies of General Interest

Brownell (3) felt that progressive businessmen in some communities would be shocked to see that while they have scrapped outmoded lighting, machinery, and furniture and have air conditioned and made sanitary their offices, working areas, toilets, and restrooms, they are sending children to school in poorly lighted, poorly ventilated quarters and asking them to work with equipment that handicaps rather than facilitates the business of education.

Reid (18) gave numerous examples of how an architect, properly aware of educational objectives, may make parts of the school structure the means of furthering those objectives.

Broom, Thompson, and Condon (2), with the aid of extensive tabular and graphic presentations of the results of numerous semitechnical studies, revealed "how these facts can be translated into procedures and practices that will improve classroom environment . . . in order that children may enjoy the greatest opportunities possible in our public schools."

Schools should be "living organisms, not frozen into a shape by outmoded accommodations," is the theme of an able and pointed discussion and analysis by Baker (1). He recommended buildings designed for not

more than a twenty-year life, cheaply erected, easily remodeled, or removed, and having high salvage value instead of traditional school buildings described as "monuments to outmoded educational theory."

The inability of teachers to accomplish desired results, because of careless building planning is deplored by Dent (7). In classrooms with no service electric outlets, teachers are denied the use of modern visual aids. The installation of such outlets after the building is constructed is expensive. Dent said that equipment manufacturers have made available planning services that can be used to advantage.

Lescaze (13) declared that educational programs have progressed far in advance of the planning and design of school buildings. He wondered why schoolboards sponsor progressive educational programs yet at the same time "retrogress to obsolete architectural formulae" when new school buildings are considered. Flexibility is reported as the key problem if our school buildings are to meet "more adequately the new demands of new methods of education."

Educators, school plant surveyors, architects, and many other interested and competent persons today believe that it is possible for the school plant to make a more substantial contribution to the realization of educational objectives. Such a contribution can be expedited by: (a) experience and research in methods of using and evaluating the planning potentialities of educational staffs; (b) research that would reveal the degree to which the nature of the plant, and plant inadequacies, are contributing factors to the time lag between the adoption or authorization of new curriculums, methods, or services and their general and effective operation; (c) exploratory research into the correlation of plant provisions with educational results; (d) research studies of the effectiveness in use of plants designed for flexibility and of the possibilities of further exploitation of planning for inexpensive alteration.

Continuous cooperation and interaction among teachers, curriculum makers, teacher trainers, and school plant planners is essential if education is to be given even the possibility of being tooled, and, when necessary, retooled as adequately as are industrial plants for their purposes. This can be made a reality only when the public as well as the teaching profession comes to know specifically what is involved and to believe that it is worth what it costs.

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CHAPTER IV

Staff Participation in Plant Planning

HAROLD E. CHASTAIN

EVIDENCE FROM THE FIELD indicates that the full utilization of school faculties and noncertificated personnel in planning educational plants is yet largely sporadic and incidental. Altho the philosophy of teacher participation has practically reached the undebatable stage (38), practice lags woefully. Research which explores actual values and specific types of contributions which school staffs might make are negligible, and studies involving technics and procedures of utilizing the intelligence and experience of teachers are needed. An increasing number of excellent examples, however, are in evidence.

Plant Planning and Democratic School Administration

The desirability of participation in plant planning is inherent in the concept of democratic school administration, and, hence, of democracy itself. Collective attack on educational problems, as stressed by Leonard and others (19), is necessary.

The role of the teacher, according to Rhodes (33), is solely involved in policy-execution rather than policy-making. Palm (29) pointed out that the newer conception of staff sharing in the making of decisions "... should not be thought of as a favor granted by the administration, but rather as a right and obligation." Reavis (31) stated that democratic participation "... means disagreement, discussion, more disagreement, further discussion, resulting in a final course of action, which, in many cases is a compromise. . . ." Opportunity for all interested persons to join in the formation of plans and purposes for the common good was emphasized by the California Elementary Principals Association (5), Williams (38), and Tyler as quoted by Reavis (31). Rhodes (33) saw in the movement to give teachers a share in policy-making, a return to the democratic principles in effect about a century ago when schools were administered directly by lay boards. Barham (3) considered it as a current manifestation of the reconstruction and extension of the concept of democracy while Reavis (31) emphasized the necessity to differentiate between different grades and degrees of professional and technical competency in its use.

General Treatments of Democratic Administration

General treatments of democracy in school administration, with its many ramifications, were evidenced by the works of Miller (25), Koopman, Miel, and Misner (18), Moehlman (26), Reavis and Judd (32), and Rhodes (33). Williams (39, 40) described a questionnaire study which brought out the discrepancies between viewpoints of teachers, principals, and superintendents, in six selected school systems, as to the actual effectiveness of

teacher-participation in twenty-eight phases of administration. On the item, "Planning School Buildings," only 13 percent of teachers believed that their participation was bona fide, while 56 percent of the principals and 56 percent of the superintendents believed it to be more than mere consultation.

Effects of Participation on Schools

Among the advantages to education in general and to school systems in particular accruing from staff participation in administrative policies are the marshaling of intellectual resources and the wisdom and judgment of those whose business it is to make the school an efficient organization. To these Barham (3) added goodwill, cooperation, and enthusiasm. Loomis (21) asserted that teacher-participation strengthens the democratic program without impairing the rights of the people.

Effects on Teachers

If all school procedures and processes are established in order to make good teaching possible, the effects of democratic policy on teachers assume a position of importance. California Elementary Principals Association (5) pointed out that one achievement by an individual increases both the desire and the ability to engage in other undertakings. Other teacher gains to be realized by participation mentioned by Williams (40) were increased growth, morale and *esprit de corps*, better understanding of local policies, greater breadth of vision, initiation, increased responsibility, and the tendency to practice like relationships with pupils. "There is no substitute," said Greene (12), "to take the place of responsibility."

Thus, the principle of participation passed from the stage of mere gesture and "sops to Cerberus" to the point where, as Pierce (30) stated, "it increases the effectiveness of school work." Gilchrist and Woelfel (11) believed that student as well as teacher cooperation in the selection of equipment increases the respect for property and an appreciation of what money can buy.

Avoiding Past Mistakes

The inclusion of the teaching staff in plant planning is essential, affirmed McGrath (22), to help avoid the costly mistakes of the past. Yager (41) listed ten oversights in the construction of a teachers college laboratory school which might not have occurred if planning had included the advice of sound-thinking teachers who were familiar with day-to-day instruction. When the significance of teacher contributions are realized, especially in the above areas, said Bursch (4) "... it will become obvious that no school building can be as well planned without the assistance of the teaching and supervisory staff as with such assistance." Miller (24), in an outline of procedure in building, advocated very emphatically the enlistment of every teacher.

Teacher Participation Essential to Functional Planning

The close connection of form with function, as mentioned by Moehlman (26), adds weight to the recognition and use of the technical competence of teachers as well as architects, engineers, and business managers advocated so strongly by the Educational Policies Commission (28). To this end Smith (36) said: "The best school building is the one which is planned functionally; which translates the educational aims, methods, and ideals into an actual workable program."

To this point, Rosenstengel (35), Stowell (37), Miller (24), Holmes and Shigley (15), Engelhardt and associates (10), and Engelhardt and Engelhardt (9) have commented at some length while the latter also emphasized community usage as a basis for planning.

Effective Areas for Staff Participation

Among specific items on which teachers may assist, McIntosh (23) mentioned size and arrangement of the rooms, lighting, and furnishings. Logan and Cleveland (20) added workbenches, sinks, height of blackboards and bulletin boards, special display facilities, window seats, alcoves, fishponds, space for special activities, provision for small group conferences and activities, storage space, and creative activity facilities. An example of the type of assistance in fore-planning contributed by teachers was described by Holmes (14) in his description of the new J. W. Sexton High School of Lansing, Michigan.

Collaboration as a Policy

From the standpoint of utilizing the staff adequately in plant planning an emphasis has been placed on architects, schoolboards, administrators, and special consultants to be collaborators in the fullest sense. Bursch (4) and Creighton (8) stressed board cooperation; Stowell (37) and Holmes and Shigley (15), the architect; and, Hanson (13), and Koopman, Miel, and Misner (18), the collaboration of the consultant.

Effect on Public Relations

That the fullest participation of staff and laymen pays dividends in public relations was shown by the accounts of Houston (17) and Hanson (13). Success in obtaining public fiscal support was attributed to the widespread knowledge and goodwill engendered by democratic sharing in the plans.

Staff Collaboration as a Continuous Policy

From the literature a number of cases were evident in which staff participation in administrative policy-making, including school plant planning, was a consistent continuous policy. In San Diego, California (6), an executive council representing all branches of the professional staff met periodically to determine policies which included problems of school building and

equipment. Likewise, at Saginaw, Michigan (24), an elected coordinating council chose an executive committee to formulate plans and policies and to assist in plant planning. Under the direction of experts from the Harvard School of Education, teachers, city officials, school administrators, and selected laymen of Brewer, Maine (17), met for an extended period to study building requirements in relation to the educational program, the community needs, and financial resources. One result was a successful bond election for school building purposes. In Burbank, California (28), elementary and secondary teachers worked for months in planning buildings and equipment. To perfect plans for a new rural elementary school, teachers, custodians, trustees, the administrator, and the architect, at Avenal, California (2), sat around the conference table monthly for an entire year.

Examples of Cooperative Planning

Among other recent building programs where teachers, custodians, principals, parents, supervisors, and pupils were given a definite share in the planning, were those at Waterloo, Iowa (20); Green River, Wyoming (23); Elmont, Long Island, New York (13); Lansing, Michigan (14); Lincoln, Nebraska (1); and Tucson, Arizona (27). In Amarillo, Texas (34), the superintendent, business manager, both girls' and boys' physical education teachers, and the architect studied and planned together to produce the layout for a combined girls' and boys' gymnasium plant which now satisfactorily serves 1000 pupils of both sexes.

Plans for a swimming pool to serve a high school and junior college at Auburn, California (6), were initiated by a planning committee composed of members of the physical education and health departments of both schools, the maintenance personnel, and the administrative staff. Williams (40) reported, that, in the planning of the Crow Island School of Winnetka, Illinois, the architect spent several weeks in the schools of that community, attending faculty meetings and watching pupils and teachers at work in order to catch the spirit and philosophy as expressed in actual practice. The result was a building to fit the educational program.

A portfolio of elementary-school classroom designs, collected by Engelhardt and associates (10) in a large measure reflected the cooperative participation of teachers in the original planning. Koopman, Miel, and Misner (18) reported a study in which an architect's plans and model were submitted to a teaching staff for critical analysis. The teacher reaction was studied by an educational building consultant who classified their suggestions. Twelve were judged practical, six debatable, and only two were declared impractical.

The Future of Staff Participation

Holmes and Shigley (15) summarized the question of staff participation when they declared: "Whether your goal is a whole new school plant, a new music or shop building, or merely the better use of existing facilities.

begin now to solicit suggestions from your teachers." As to the future Engelhardt and associates (10) predicted that "... human relationships and the learning processes themselves will play greater roles in future planning." Finally, as Rhodes (33) so aptly stated, "Until the schools reflect democratic thinking in every aspect of their structure and operation, they are not fully prepared to nurture and protect the democratic concept in the mind of youth."

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CHAPTER V

Wartime School Plant Facilities

ANDREW H. GIBBS

SCHOOL FACILITY NEEDS precipitated by the shifting and concentration of population as a result of the war program were reported to Congress in a study by the U. S. Office of Education (33). This preliminary study revealed that hundreds of local communities were unable to provide adequate school facilities and services and served to point out the obligation of the federal government to lend financial assistance where these concentrations of need occurred.

Because of the serious shortage of critical materials and manpower, the federal government was faced both with facilitating and restraining school construction; facilitating and providing it in war areas where influxes of population overtaxed existing facilities and restraining it in nonwar areas. Effective facilitation was achieved thru passage and implementation of the community facilities amendments to the Lanham Act (1, 19) and curtailment of nonessential building (11, 18) resulted from the priorities system established under the War Production Board.

The Lanham Act and Its Administration

Practically no school building construction was carried on during the defense and war period except under the Lanham Act and its amendments and to replace burned buildings. These Acts—Public Laws 849 (October 14, 1940), 137 (June 27, 1941), 409 (January 21, 1942), and 150 (July 15, 1943)—authorized the appropriation of federal funds in the amount of \$500,000,000 for community facilities including school construction and maintenance and operation of school facilities (2, 19).

Since the Lanham Act was administered by the administrator of the Federal Works Agency, information on progress and accomplishments in providing school facilities in the war areas was found in the annual reports of that agency (15, 17, 18), and in its processed monthly statistical tables (16) issued for use of its Washington and regional offices primarily, but sent to individuals upon request. The annual reports of the U. S. Commissioner of Education (31, 32) showed the activities of the office in cooperating with the state departments of education, the Federal Works Agency, and the War Production Board in determining educational needs.

Approximately 900 certificates of necessity were issued by the U. S. Commissioner of Education (32) to the administrator of the Federal Works Agency during the biennium 1941-43. After August 12, 1943, these determinations of educational need were made by the Federal Works Agency under a joint agreement entered into by the Federal Works Agency, the Federal Security Agency, and the Bureau of the Budget. This joint agreement says in part:

The Federal Works Agency is equipped to determine the need and extent of need in cooperation with local governments. The Federal Security Agency has not heretofore been called upon for recommendations regarding PWA, WPA, or other school construction projects, and has no responsibility for standardizing such facilities. It is agreed that no recommendations by the Federal Security Agency will be required for these facilities.

Michaelis (25), in a doctoral dissertation, analyzed the administration of the Lanham Act school program with reference to the problem of federal control over public education. He found that "some minor, temporary controls over certain local school jurisdictions indirectly resulted" but that "no new significant controls over public education developed . . . as of August 1, 1942." Some of the periodical literature on the subject shows various emphases on and interpretations of the program and its administration. Joyal (24), for example, expressed concern about federal control; Morphet (26) and others (8) were dissatisfied with the procedure of having determinations of educational need made by a noneducational agency; and an editorial in *Nation's Schools* (27) made accusations of muddling.

The federal government's participation thru the PWA and WPA programs in the construction of schools and educational buildings was extensive and carried over into the fiscal year 1941 (17). This broad experience in school construction was acknowledged in the joint agreement, part of which was quoted above, under which the FWA made determinations of educational need in war areas. In addition, PWA and WPA facilities and personnel were utilized in the defense and war public works programs of the FWA. Because of this tie-in of these constituent agencies of FWA in the peace and war program of school building construction, Branom's study (7) is interesting in showing the influence of PWA on construction costs and its major permanent effects. He did not, however, assay the effect of the location of PWA school buildings on the state program to improve attendance-area and administrative-unit organization—which study should be made for the Lanham Act as well as for other school building construction financed wholly or in part with federal funds.

Replacing Burned Buildings

The U. S. Office of Education issued approximately 400 statements of need to the War Production Board for school plant facilities, principally needed because of fire or condemnation proceedings (32). These were not Lanham Act projects and were constructed wholly with local and state funds.

"Temporary" School Buildings

The Federal Works Agency issued, under date of February 16, 1942, a set of plans (twelve sheets) for various size "temporary" school buildings limited to one- and two-story masonry and one-story wooden structures. Under date of July 15, 1942, a second set of plans (sixteen sheets) was issued by FWA for various "typical units" of emergency school buildings.

These plans were used by employees of the FWA and the U. S. Office of Education when visiting localities to determine need; they were not available for distribution.

Buildings constructed by the FWA were described in 1942 as follows:

The typical school building was a one-story structure with a simple space-heating system, minimum plumbing, minimum lighting, and a combined lunch-assembly-recreation room. No gymnasium or auditorium was permitted; no radio, electric clock, or signal system; no architectural embellishments. (18)

As a result of a preliminary study of the adaptability of demountable prefabricated building construction to school building, Barrows (5) concluded that they were practicable. She felt they were highly desirable in the war areas with urgency for immediate use; they were relatively inexpensive; and their use was not limited to the emergency period. This is a thought-provoking circular. It might well be considered in local school unit reorganization programs. Hacker (20), Power (29), and Reid (30) also urged the use of temporary construction.

Wartime Restrictions

The so-called "200 percent-utilization" agreement between the War Production Board and the Federal Works Agency, which became effective in June 1942, increased the problems of schools in the war areas. This agreement provided that no new school should be constructed or an old one enlarged until the existing school facilities in the area were being used two shifts daily—200 percent of normal capacity (18). This resulted in double sessioning in some or all schools in the war areas before new construction was approved; special conditions did not permit rigid application of the rule.

Federal restrictions on the use of critical materials appeared in the *Federal Register* (14) and many of these orders affecting schools and some interpretation appeared in the *American School Board Journal* (3, 13), *Nation's Schools* (21, 23), the *School Executive*, *School Management*, *School Business Affairs*, and *Education for Victory* (10, 12). Holy (22) showed for five cities actual and proposed expenditures for supplies. He indicated that there had been a marked drop in expenditures for new and replacement equipment during the same period which reduction probably resulted from inability to purchase.

War Production Training Equipment Needs

Equipment needs arising out of the program for training workers for war production of the U. S. Office of Education were serious. Congress appropriated thirty million dollars for the acquisition of equipment in connection with the supplementary and preemployment refresher courses (31, 32) and procedures were effected with the Office of Production Management for securing preference ratings for training equipment. Some of the schools themselves made small tools and precision measuring instruments.

Bibliographical Note

The total literature on wartime school building is meager. Official documents such as the *Federal Register* (14) show as of the date of issue the regulations and notices of the Office of Price Administration, the War Production Board, and other federal agencies. The individual applications of local school administrative units to the Federal Works Agency and the War Production Board for facilities and priorities for schools (and the field studies on file in the U. S. Office of Education) are not yet available for public use. The internal administrative orders of the Federal Works Agency are duplicated for use of its employees and cooperating agencies in Washington and the regional offices and are not generally available to individuals not in its employ.

Since the official documents on file in the several federal agencies concerned with the program are not available for study, the research in this field must come later. Particularly helpful to the educational research worker, when these documents become public property thru deposit in the National Archives, will be those data on the project applications enrolments, teachers, cost of construction, tax rates, and revenue. It is to be hoped that after they become available, these reliable data will contribute studies that show the effects of federal subsidy, construction practices, and costs of school buildings.

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CHAPTER VI

Plant Facilities for Vocational Education

WARD P. BEARD

ONE OF THE BASIC PRINCIPLES of vocational education is that buildings and equipment used in the training for an occupation should afford learning situations as nearly as possible like the working conditions in the occupation. Standards for buildings and equipment, therefore, have been determined largely by the kinds of buildings and equipment used in industry, in stores, on the farm, and in the home.

No record has been found of any literature of recent date bringing together and describing what might be considered standards for buildings and equipment in all fields of vocational education. This was done in 1921 in a chapter on "Buildings and Equipment for Vocational Schools" by J. C. Wright, assistant U. S. Commissioner for Vocational Education, in *School Architecture, Principles and Practices*, by John J. Donovan, a book published by the Macmillan Company.

This review reveals the need for (a) more objective research similar to that of Stayton (29) and Anderson (2); (b) introduction of experimentation instead of survey; and (c) use of objectives of courses as a major factor in determining equipment.

Agricultural Education

Bille (4) recommended standards for three types of vocational agriculture departments based upon the scope of their offerings. Room plans, including facilities for each of the three types of departments, were prepared. The most desirable types of equipment were illustrated and described. Layman (18) studied schools with an average enrolment of 105 boys and an average of 387 facilities valued at slightly less than \$1000. On the basis of this study he made recommendations for classrooms and shops including facilities. Thurman (32) studied equipment lists for vocational agriculture departments in twenty states and developed suggested lists of equipment for such departments. Several states (1, 12, 20, 23, 37) described space, equipment, and layout and gave recommended lists of tools and equipment. The chief of the vocational agricultural education service (33) in a mimeographed letter of January 7, 1941, to state supervisors of agricultural education described and transmitted a drawing of a floor plan for a farm shop accommodating twenty to twenty-five pupils and providing for work in wood, concrete, metal, and electrical and general repair work.

Business Education

Kyker and Walker (17) discussed trends in vocational training for office occupations, giving a floor plan and list of equipment needed. Blackler (5) discussed model stores, school-store equipment, and selection of equip-

ment. Fisk (11) pointed out that business education requires less equipment than required for most other types of vocational education. Equipment was described for the several fields of business education. Criteria were outlined for selection of equipment.

Home Economics Education

Hunt (13) found that when thirty-one high-school home economics departments in Texas changed from a nonvocational to a vocational program, the change resulted among other things in more efficient business management. Stayton (29) determined by measuring 100 girls the optimum height of tables for girls standing and sitting at work and made recommendations for numbers of chairs and tables of each height if variable heights are to be used. She also made recommendations for adjusting heights and developed a design for a clothing laboratory table for both standing and sitting students. Anderson (2) derived dimensions for tables and cabinets used for high-school foods laboratory work by taking various measurements of 187 girls. Standards were developed for heights of working surfaces, $32\frac{1}{2}$ inches; rim of sink, $37\frac{1}{2}$ inches; pull-out board for beating, $30\frac{1}{2}$ inches; minimum length of counter or table for two girls working side by side, 60 inches; maximum height of top drawer, 58 inches; and many other standards.

Dougherty (10) developed a list of specific utensils for each unit kitchen in a high-school homemaking department on the basis of questionnaire, interview, study of literature, and laboratory tests. A list of utensils for general use and storage in the homemaking laboratory was also developed. A third list included utensils desirable for demonstration purposes. A fourth list described in detail various utensils and gave uses, place of storage, and points to consider in selection.

O'Reilly (24) stated advantages and disadvantages of various locations, arrangements, and equipment for homemaking departments. Opinion was widely divided on all but a few questions indicating many unsolved problems and adaptation to a wide divergence of local situations. Several states (9, 14, 21, 34, 35) and a city (25) outlined plans for homemaking departments with drawings, pictures, lists of equipment, and floor plans. Blazier (6) related how rooms and equipment developed with curriculum revision.

Trade and Industrial Education

Struck (30) pointed out that the heavy use of equipment in the program of training workers for war industries affected selection of equipment and its care. He recommended live records on equipment, systematic inspection, breakage reports, proper supervision, and repair by instructors. Murri (19), Novascone (22), Karch (15), and Coleman and Oppermann (8) presented floor plans showing arrangement of equipment. Parkes (26) did the same for a factory type self-contained unit in a technical institute of the vocational-technical type.

Miscellaneous

Architectural Record (3) has reprinted material on a three-fold education program covering industrial arts, prevocational and vocational training giving plan types for each, case studies of four vocational schools, floor plans and a table showing floor area per student, illumination needs and type of floor for each kind of room or shop. Chamberlain's survey (7) showed data in regard to floor areas, value of equipment including extent and kind of power machines. Roehl (28) described a shop suitable for teaching general repair work in a rural community, giving floor plan and other description. The Wilmington Board of Education (36) published a brief description with pictures and floor plans.

Komow (16) developed a formula for computing number of shops. He recommended a maximum of twenty-five pupils per shop, length of shop never more than twice the width, located on ground floor away from other departments, and equipment the latest in use in industry.

Rawlins (27) used the questionnaire, critical reading, and experimentation to determine the status of lighting in some school shops in Ohio to find the reaction of pupils to ideal lighting recommendations as made by authorities, and to determine ideal lighting conditions for an industrial arts shop. He found many school shops inadequately lighted, made recommendations for good lighting practice, and found that pupils are dissatisfied in working under poor illumination and in most instances the pupils utilized light of higher intensities than those recommended by experts. He called attention to the need of educating school authorities on the neglect of shop lighting. Wright (38) found the lighting and ventilation of shops in East Texas inadequate.

The regents of the University of the State of New York (31) outlined needs and proposed building program for "Agricultural and Technical Institutes and the Maritime Academy," and for new "Institutes of Applied Arts and Sciences."

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CHAPTER VII

Plant Facilities for Higher Education

E. T. PETERSON

SINCE THE SECTION on Plant Development for Higher Education was omitted in the last school plant issue of the REVIEW OF EDUCATIONAL RESEARCH, this chapter reviews the literature beginning in April 1938. Work in this field continues to be characterized by relatively few substantial investigations and by numerous articles which describe and analyze individual college building projects. No attempt has been made to include all material in the second group. Representative projects illustrating various types of college buildings have been selected and reviewed. In most cases the planning of these projects gives evidence of more research of an informal nature than is apparent on casual inspection.

There is encouraging evidence that functional planning is increasing at the college level. There is less conformity to rigid and uniform campus architectural schemes usually dominated by extremely traditional types. There is more emphasis on detailed determination of educational requirements and on honest, direct, and consistent translation of requirements into design and treatment. The lesson seems at last to have been learned that this procedure need not sacrifice aesthetic values.

For readers unfamiliar with the college plant field, it may be observed that the *American School and University* continues to devote more attention to building problems in higher education than any other periodical.

General

Evenden, Engelhardt, and Strayer (12) published an extremely significant volume, extending to college buildings their series of standards for various types of school buildings and designed for use with their score card technic. The major sections were site, buildings, service systems, instruction rooms, and general units. A supplementary set of standards was included for teachers colleges. These standards bring together the results of scattered research and the composite judgments of competent educators, architects, and technicians in a systematic sequence which facilitates use in both evaluation of existing plant and in the planning and construction of new units.

A shift from traditional and uniform college classrooms to rooms of individual character planned to meet specific purposes was advocated by Harrison (19). He illustrated his ideas by drawings of a student forum unit, a mathematics suite, a science laboratory, a lecture room, a project and seminar room, and a language room.

Campus Plans

Smith (37) presented four comprehensive university campus plans at Illinois, Michigan, Ohio State, and Wisconsin. He analyzed needs in three

stages: (a) a relatively small program for immediate postwar execution; (b) a secondary postwar program planned for execution as funds are available; (c) indefinite future construction. He emphasized the importance of coordinated planning of space provisions for three new areas—radio, nutrition, and international relations.

Several college campus plans were discussed by Hill and Taylor (20) with emphasis on principles of landscape development.

Patterson (34) described the first two buildings on the new campus of the University of Houston. The first quadrangle is being developed around a reflecting pool. Buildings are air conditioned.

Libraries

Hanley (16) presented floor and section plans, photographs, and brief descriptions of forty-two college and university library buildings. Emphasis was on functional planning. Included was a brief discussion of essentials in library planning and a summary chart of comparative cost and size data and a comprehensive, annotated bibliography.

Walter (45) considered the general problems involved in university library planning with illustrations from the libraries at Dartmouth College and the universities of Colorado, Minnesota, Utah, and Yale.

A new approach was suggested by Ellsworth (8) with emphasis on maximum flexibility and continuous adjustment to the instructional program—the learning laboratory, not the monumental building. A development of the unit plan was proposed with low ceiling heights and a skeleton of steel columns carrying movable partitions or shelving. The idea was illustrated by a detailed description of provisions for a social studies area.

Science and Industrial Buildings

Cocking (4) summarized nineteen articles on planning and servicing science laboratories appearing in the *American School and University* from 1930 to 1943, ranging from a single building housing all sciences to the Technological Institute at Northwestern University.

The new Technological Institute at Northwestern University, which houses civil, chemical, electrical, and mechanical engineering and the departments of physics and chemistry was described in detail in three articles by staff members (11, 33, 39). The building has a volume of 5,000,000 cubic feet, and the floor area is 450,000 square feet. A complete set of floor plans is reproduced. Of special interest are the detailed descriptions of the highly specialized research laboratories in physics and chemistry, which reflect an enormous amount of careful planning. Fluorescent lamps provide illumination of twenty-five foot-candles on the tables. There is an unusually attractive and functionally designed lecture-demonstration room with 200 seats arranged in quarter circles on graduated steps.

The architects, Holabird and Root (21), presented a well-illustrated discussion of the special features, including "the quietest room in the world," a room "where it always rains," a two-and-one-half story laboratory with

a million pound transverse-universal testing machine, cold rooms, and so forth. The drawings included a combined elevation and section.

Burns (2) described the new science building at Appalachian State Teachers College. The planning was characterized by carefully organized staff participation which included specially designed equipment.

The floor plans and course offerings of the new industrial division plant of Santa Barbara State College were described by Ericson (9).

Theaters, Art, and Music

Hare (18) assembled extremely valuable planning data and standards on theater design, stage requirements, lighting and acoustic planning. Complete case studies were presented of the University Theater, University of Iowa, and of the Theater Wing, Wisconsin Union, University of Wisconsin.

Cole (5) analyzed the floor plans and facilities of the Kirby Memorial Theater at Amherst College and the Adams Memorial Theater at Williams College. Both were designed as theaters with no direct attention to multiple use. The analysis is keyed at every point to the problems of play production in a college theater.

Scholer (36) gave a complete description, with photographs, plans, and isometric section, of the Hall of Music, Purdue University, the largest building of its kind in the country. The auditorium seating capacity is 6208. Excellent provisions are included for campus musical organizations, radio studios, and auxiliary rooms.

An unusual grouping of facilities for architecture, fine arts, and art galleries at the University of Southern California was described by Flewelling (15).

Physical Education

Houston (23) visited the women's physical education departments of forty-eight colleges and universities and studied intensively the programs of activities and the school plant facilities of seven large institutions. The study included an excellent review of the developing housing program, and the analysis of facilities in seven colleges was enriched by nearly a hundred photographs and a large number of floor plans. This study received the honor award of the American Academy of Physical Education. An excellent summary of the findings and recommendations was published in the *American School and University* (24).

Mitchell (32) summarized wartime emphasis and trends in college physical education and indicated areas of carry-over after the war as obstacle courses, running and swimming facilities, camping, more complete health examinations, and correctives. He proposed changes in locker and shower room design, simpler roof structure, increased use of the stadium, better sanitary facilities, more attention to play area surfaces, and more complete instructional equipment.

Diemer (7) reviewed the facilities of a carefully planned health and

physical education unit at Central Missouri State Teachers College. The problems presented by coeducational use of the structure in a teacher training program were solved with unusual success.

Loebs (30) presented a detailed planning procedure for corrective exercise rooms with a condensed statement of standards and a check list of equipment.

Fetzer and Cornwell (13) gave a detailed summary of the specifications and layout of the new \$600,000 gymnasium at the University of North Carolina. Special features were the flexibility of use of the large gymnasium, 150 feet by 250 feet, the ample provision of smaller specialized rooms, and an excellently planned pool.

Residence Halls

Cocking (3) reviewed sixteen articles on dormitory planning and operation in issues of the *American School and University* from 1930 to 1943. He noted a decided shift in function from mere housing to the provision of a varied educational living environment.

Ingemann (26) summarized the results of a questionnaire on types of accommodations best suited for girls' dormitories in twenty-seven colleges. Opinions favored dividing into groups of not over sixty with single study bedrooms opening on corridors rather than around individual stair halls.

Based on his experience in designing recent dormitories at Ohio State University, Smith (38) analyzed eight projects ranging from \$650 to over \$2000 in cost per occupant with practical suggestions of the limitations imposed on facilities by budget requirements, both in planning and operation.

Trautman (42) described a new dormitory at Baldwin-Wallace College to house sixty-three men. Special attention was devoted to specifications which minimize maintenance problems.

Johnston and Jones (29) presented the floor plans of a compactly designed apartment building for married graduate students and instructors on the agricultural school campus of the University of Minnesota; cost \$160,000, capacity thirty-six apartments. This type of facility will be in great demand in a number of institutions in the postwar period.

The close relationship between proper planning of residence halls and their operation and management was stressed by Hunter (25). Rollins (35) reviewed the experience of Northwestern University in planning dining halls, kitchens, and cafeterias. Included are planning suggestions, equipment standards, and useful hints in operation. Terrell (40) emphasized the importance of identifying the work to be performed as a basis for successful planning of residence-hall kitchens. Well-planned units were illustrated by photographs. Based on an installation of food-service equipment at Syracuse University, Webber (46) outlined the specifications and functional arrangement of a food counter with many labor saving and automatic devices.

Teacher-Training Facilities

Ballard (1) reviewed the facilities of the school of education building at Stanford University, the gift of former Dean Cubberley and planned by him.

Holmstedt (22) presented the special features designed to adjust to a teacher-training program in the new university school at the University of Indiana. The school is a complete unit, nursery school, and elementary and high schools organized on the 6-6 plan.

Operation and Maintenance

Whitney (47) described the derivation and use of certain measures of boiler efficiency, emphasizing BTU, unit evaporation, fuel fired, and steam consumed. In computing heating plant unit costs, he suggested steam produced fuel, wages, and repairs. In studying electric light and power load, he employed a time series analysis with charts of daily, weekly, and seasonal load curves.

Veech (43) reviewed the reorganization of the maintenance program at Washington and Lee University with emphasis on periodic, systematic inspection reports.

Miscellaneous

Coleman's study of museums (6) was sponsored by the Carnegie Corporation and was based on visits to 200 colleges and universities. It was richly illustrated by photographs and floor plans. Art, science, and history museums received separate treatment, and the discussion of the function of museums in institutional programs is replete with helpful suggestions in planning and design.

The facilities of the Coffman Memorial Union at the University of Minnesota were described and illustrated by Johnston and Jones (27). This \$2,000,000 structure with 280 rooms meets all the requirements of a student campus center and contains a faculty club.

The needs of students with minor ailments and the needs for observation and isolation were provided for in a Health Service Building on the St. Paul campus of the University of Minnesota. This building was described by Johnston and Jones (28).

Evans, Moore, and Woodbridge (10) presented plans and photographs of a highly specialized alumnae building at Smith College including a social club, conference halls, and offices. Wahl (44) reported the highly specialized facilities incorporated in the new medical research laboratory at the University of Kansas. Magrath (31) described a project of alteration and enlargement of the business offices at the University of New Hampshire. Plans were described by Thayer (41) for a college greenhouse which includes a student laboratory.

Junior Colleges

Hardesty (17) discussed library utilization in the instructional program of the junior college and made suggestions for location, space, lighting,

acoustics, and equipment. Fisk (14) based his discussion on an analysis of equipment in use and desired in occupational business courses in forty junior colleges. He illustrated by numerous photographs the battery and the rotary plan of equipment installations, the production laboratory, the retailing classroom, and the model office.

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CHAPTER VIII

School Plant Lighting

CHARLES D. GIBSON

BECAUSE OF THE WAR IMPACT and its restrictive implications for electrical materials and equipment, very little of the research or very few of the significant publications available for review dealt with artificial lighting. This circumstance probably was one of the better things resulting from the war, as it gave an opportunity for accent on the present and developing role of daylight as the major light source for schools.

The Present Status of School Lighting

A report by Dates (8) summarized the story of improved school lighting from 1918 to 1940. This report also recorded the results of a survey made in 1940 to determine the progress in school lighting and to create a picture of lighting practices in classrooms over the United States. Data were gathered representing some 250,000 classrooms in forty states and the District of Columbia, about 20 percent of the nation's schoolrooms.

Some of the results of this nationwide survey were indicative of the status of school lighting in 1940. Because of war-created restrictions on lighting equipment, the results of a 1940 survey still are acceptable in 1944. The survey indicated that:

1. Twelve percent of all school lighting installations met the specifications of the 1938 American recommended practice of school lighting.
2. Sixty-six percent of the installations in new schools conformed to these specifications.
3. Sixty-seven percent of the relighting jobs during the 1939-40 school year conformed to these specifications.
4. The average intensity of illumination in the schoolrooms was about seven foot-candles.
5. Type of luminaries in use were as follows:

	<i>Percent</i>
a. Indirect	5
b. Semi-indirect	10
c. General diffuse i.e. enclosing globes	70
d. Direct	15

It may be noted, however, that in the Texas School Adequacy Survey only 3193 of the 11,060 schools included had electricity (6).

The Trend

One of the most significant developments in the lighting field during the past few years has been the shift of emphasis from foot-candle intensities to considerations of brightness, brightness contrast, and brightness ratios as the controlling factors in the maintenance of good seeing conditions. Taylor (33) stated that brightness and brightness contrast are the

most fundamental factors affecting seeing and are actually the end products of illumination. He worked out tables which illustrated the range of brightness encountered in natural and artificial lighting and described in detail the instruments now available to measure brightness.

Luckiesh (24) sounded the warning "Beware of the limitations of foot-candles. They are a measure of the level of illumination but they alone do not determine the brightness. And brightness is a controlling factor in lighting for comfortable seeing."

Harrison and Luckiesh (13) stated that for years it has been recognized that comfort in lighting is, for the most part, a matter of quality of lighting or "distribution of brightness in the entire visual field."

Reporting on the results of a survey that covered many of the electrical industries in the United States, Williams (35) stated that "The level of lighting (intensities) seemed to interest a substantial part of the people who gave me information *much less* than the quality. This is a fine trend. . . ."

Luckiesh (23), at one time, struck the keynote in the change of emphasis in illuminating engineering and summarized the limited, significant research relating to brightness as the prime factor in the critical task of seeing. From a rather narrow foot-candle fetish, he indicated the trend as being toward a wider and certainly a more scientifically defensible consideration of brightness and its many ramifications. This article developed the thesis that "a visual task is inseparable from its environment," and that "the distribution of brightness in the visual field determines the seeing conditions."

Brightness Contrast and Brightness Ratio

The terms "brightness contrast" and "brightness ratio" have been used interchangeably in much of the lighting literature. Luckiesh (23) by definition and illustration, drew a logical, clarifying difference between these two terms which undoubtedly will do much toward bringing more needed explicitness into discussions in this field.

Brightness Limits

Fowler and Crouch (10) covered the subject of brightness limits for lighting systems. These men established basic formulas by correlating many noteworthy researches, particularly by Holladay, Luckiesh, Meaker, Nutting, and Potter. These scientifically established formulas were then translated into practical applications.

An acceptable range of brightness for adjacent areas in a visual field was recommended by Harrison and Luckiesh (13) to be between 10 to 1 and 50 to 1. Luckiesh (23) defined the limits of acceptable brightness contrast and ratios and applied his formula to typical visual fields and seeing tasks. Brown (2) advocated the brightness ratio of 100 to 1 as the acceptable maximum.

Brightness and Glare

Glare is defined by Fowler and Crouch (10) "as any brightness within the field of vision of such character as to cause discomfort, annoyance, interference with vision or eye fatigue." Direct and reflected glare are defined, analyzed, and discussed. The "relativity" of glare as evidenced by brightness contrast is developed in a comprehensive way. A summary of the various researches dealing with the reduction of visibility due to glare states that "there is practically a unanimous finding that the reduction of visibility due to the presence in the field of view of a bright light source increases with the increase of candlepower of the glare source; decreases with increase of angle of departure of the glare source from the visual axis; and decreases with increase of brightness of the surrounding adapting field."

Brightness and Color

The shift in emphasis to brightness, brightness contrast, and brightness ratios as the controlling factors in adequate illumination called added attention to color and its contribution to school lighting. Moon (27) listed reflection factors and trichromatic coefficients of eighty-seven commercially available wall materials. He also set up and reported experiments using materials of different reflection factors on walls and floors while maintaining a matte white ceiling with a reflection factor of 80 percent. Moon concluded that the lighting effect of high reflection factors for wall areas may be fully as great as the effect of the ceiling, particularly for rooms with relatively high ceilings. He summarized his findings and stated, "Not only do highly reflecting walls allow a more economical lighting installation for the same illumination on the work, but what is perhaps more important—they reduce contrasts and tend toward a more pleasing psychological effect."

Ickes (19) discussed the importance of color and reflection factors of walls and ceilings in relation to types of light sources. He compiled a chart which gives an appraisal of wall colors viewed under various light sources and illuminated to normal brightness. Bursch (4) discussed this subject quite fully and in the discussion injected an extension of interest in color to include recommendations for furniture and chalk boards of higher reflection factors. If the necessity for reasonable brightness contrasts and ratios are accepted, interest and action regarding color in schoolrooms must include considerations of higher reflection factors of woodwork, furniture, floors, and equipment, as well as of walls and ceilings. Luckiesh (24) declared that in order to provide good seeing conditions the architect must deal with the whole interior, not just the working plane.

Hynds and others (18) made a contribution to the field of lighting and color thru a cooperative, interdepartmental study in the New York City schools. Five basic color schemes for ceilings, walls, dadoes, and baseboards were worked out and six other combinations interrelating the five basic schemes were suggested.

Daylighting and Classroom Design

One of the most marked trends in school lighting during the past few years has been the modification of classroom design to permit the greater use of daylight as a light source. Haskell (14) described and illustrated sixteen ways of daylighting classrooms. The classroom designs he discussed and illustrated were conceived to make possible a more even distribution of light intensity (foot-candles) between the inmost row of desks and the row next to the windows.

The cross sections of classrooms presented by Haskell illustrated both the modified unilateral and the bilateral technics of daylighting. The evidence given indicated the proper use of each method in buildings of different types. It is significant to note that not one of the sixteen illustrations showed a traditionally designed classroom with a flat ceiling receiving light only from one bank of large windows.

Haskell discussed such other important lighting factors as methods of controlling daylight; brightness as a prime factor in critical seeing; orientation of buildings; square floor plans for classrooms; directional glass block lighting technic; sloped ceilings; and solar heating. A summary of daylighting factors, including those presented by the general environment and by building design, was given at the end of the article.

Brown (2) gave an over-all review of the many factors involved in proper illumination of schoolrooms. His article, studied in relation to Haskell's data (14), presented the case for daylighting in classrooms. Brown stressed the great importance of properly illuminating the area surrounding the seeing task and recommended that a brightness contrast of two to one be maintained between the seeing task and the immediate surroundings for effective seeing conditions. He presented his specifications for a classroom designed for high-level daylight illumination.

In the support of planning the postwar school to take every possible advantage of design for daylighting, Nichols (28) stated that altho natural lighting in schools never has been entirely satisfactory, it still is preferable to any practicable artificial lighting so far devised.

Reid (32) exhibited sketches which indicated the distribution of daylight in rooms using both unilateral and bilateral technics. He also presented evidence to show that superior daylighting made possible by the bilateral system was responsible for the development of one-story, north-oriented, high-school plants now in use. Perkins (30) compared graphically the daylight contours in a standard classroom having unilateral lighting with the daylight contours in a classroom constructed for the use of bilateral lighting.

Those responsible for school plans are becoming aware of the need for greater window areas in the modern school than were provided in the past according to Higgins (16). He reported that bilateral lighting is again being introduced into school planning by means of clearstory lighting on the opposite side of the room from the main fenestration.

Bursch (4) asserted that "classroom planning, working under the requirement of a given classroom span or of unilateral lighting, is strait-jacketed."

Englehardt and associates (9) prefaced their study of elementary classrooms with the observation that the character of the building plan has dictated the use in the past of rectangular shaped classrooms and unilateral lighting. He maintained that these characteristics of classrooms are not necessarily good because they have been followed universally and that the state laws setting up rigid requirements regarding size, lighting, and so forth of classrooms should, in the future, "be more general in nature and less restrictive in details."

Dalle Valle (7) worked out a nomograph and table which furnish a "simple means" for obtaining answers to the following problems: How much daylight illumination will be provided by windows of a given size? How many windows must be provided in a room to secure a given amount of daylight illumination?

Control of Daylight

The acceptance of brightness and brightness contrast as the prime factors in illumination for critical seeing-tasks, and the new interest in bilateral lighting and large window areas, have accented the problem of daylight control. Recent research and practice have developed two distinct brightness control methods. The one method is based on building orientation, the other method makes use of over-all louvering of glazed areas. Both of these brightness control methods, plus many adaptations of features of each method, were illustrated by Haskell (14) and discussed by Brown (2).

The fixed louver method of daylight control eliminated the factor of orientation in building planning according to Wright (38) and made possible acceptable brightness ratios within the classrooms. This technic requires the use of supplementary artificial lighting to a greater extent than does the "orientation" technic.

In defense of control by orientation, Bursch (4) declared that "north classrooms with little or no attention to shading, produce a higher level of illumination with lower brightness contrasts than can be produced with perfectly adjusted shades of the best known types for classrooms with sunny exposures."

The uses of other methods of daylight control, such as venetian blinds, shades, and so forth, were discussed by Haskell (14) in his summary of daylighting factors. Caudill (6) stated that shades and blinds which must be regulated continually by the teacher should never be used in classrooms. He favored roof-overhangs, awnings, and light louvers installed as permanent fixtures for daylight control.

Broom and others (1) reported much school lighting information and discussed and illustrated extensively arrangements of classroom furniture in relation to daylight sources. They also compiled a comprehensive bibliography on school lighting and conducted a lighting survey in the El Paso

city schools. Thompson (34) offered data to show that uncontrolled daylight (glare from window areas) was largely responsible for prevalent body malformations among school children. He found glare to be a major factor in visual fatigue and, because of resulting posture adjustments, a direct cause of spinal curvature. The remedy suggested was based on equalized, adequate illumination with controlled brightness and on adequate seating of pupils.

Radical departures from previously accepted fenestration standards should be made only after carefully considering the adaptability of the new natural lighting schemes to local climatic conditions.

What About Foot-candles

The conclusion that the amount of light needed to produce the most efficient work still is controversial (16) is the one point of agreement among "lighting experts." An "adequate" amount of light is recommended by everyone but the definition of "adequate" runs from five to five hundred foot-candles (6). The trend, as indicated by the "research" reported in this chapter, is definitely toward placing the emphasis in school lighting on brightness and brightness ratios with foot-candle intensities being an inseparable part of the larger term "brightness."

Perkins (29) decried the acceptance of fifteen foot-candles as a classroom standard of light intensity and suggested the use of the higher intensities found in natural environments. Bursch and others (5) sponsored thirty foot-candles as a "maintained" level of illumination for classrooms after having provided for higher "initial" levels. Brown (2) stated the case for one hundred foot-candles in classrooms in terms of new daylighting technics.

"We see with our bodies as well as with our eyes." This thesis was presented by Brownlee (3) as he indicted school planners with the statement "The greatest threat to healthy eyes lies in the poor lighting facilities to be found in many of our classrooms." He urged the use of daylight or artificial light or any combination of the two to provide adequate insurance against low levels of light because of the eyestrain it produced in children.

After Holy (17) had explored the field of lighting in relation to health, he concluded that it seemed reasonable to assume that poor lighting has an injurious effect on children's eyesight. An ophthalmologist (36) entered the field with the statement "Real harm to the eyes can be caused by insufficient illumination." The matter of how much light brought forth the endorsement of fifteen foot-candles as a minimum standard along with the opinion that the matter of maximum intensities could be overdone.

Rahn (31) warned that school executives who believe they are saving the taxpayers' money by cutting down on lighting are "endangering the eyesight of children and handicapping their opportunity to learn." He presented a check list which can be used by the teacher in managing classroom illumination.

Foot-candle Trends

On the basis of a 1940 survey (8), the national average lighting level in classrooms is seven foot-candles. Averages by states were reported in this same survey to range from three to thirteen foot-candles with some individual school systems having lighting levels of from fifteen to thirty-five foot-candles. This phase of the survey was summarized as follows: "The national average is slowly but steadily rising but the new school buildings and relighting jobs conforming to specification are still too few in total numbers to offset the very large number of old installations not yet converted." Wright (39) predicted that "The higher intensities to which we have become accustomed during the war in production areas will step up lighting levels to a point equal to ten average peacetime years."

A consensus expressed in the literature and a definite point of agreement among lighting men over the country was expressed by Higgins (16) when he said that the first step and responsibility to be taken in school lighting was the elimination and replacement of the one and two foot-candle installations.

Fluorescent vs. Incandescent Lights

The war brought a shortage of "critical materials" and prevented further "promotion and exploitation of the fluorescent lamp." With emphasis on the idea of past "exploitation," Wright (39) made a plea for intelligent and honest merchandising of this new light source in the postwar period. He predicted that fluorescent lighting will take its proper place and standing among available light sources but that it will not be the "only" source. The choice between fluorescent and incandescent will be dictated by comparative cost of equipment, intensities desired, cost of electrical power, and maintenance factors. Wright also stated that the bare lamp unit was already believed to be undesirable in any important location and predicted that future fluorescent fixture design will be toward greater shielding of lamps and lower surface brightness.

High maintenance costs (20) have been cited as the greatest disadvantage of fluorescent industrial installations. Starter, lamp, and ballast failures may cause a reversal of public demand (39). Much reliable information is available on the strengths and weaknesses of the fluorescent lamp and fixture. One of these sources of information (11) gave a comprehensive story on the operation and complexities of a fluorescent lighting system.

A consensus based on operational history indicated that for lighting installations of equal quality, incandescent systems still were preferred because of the high first cost of acceptable fluorescent fixtures; rapid changes in the design and efficiency of these fixtures and their auxiliary devices; and high maintenance costs of fluorescent systems.

Brown (2) stated in his comparison of fluorescent and incandescent systems that, "When the initial price of low brightness fluorescent fixtures becomes lower, they may well be the logical choice." He pointed out that

the naked fluorescent lamp has several times the brightness considered acceptable for good school lighting practice. Some fluorescent installations considered as model in 1941 (22) do not meet the brightness standards now recommended. Winkler (37), in a convincing effort to place fluorescent lighting on a sound economic basis, presented a well-illustrated article on fluorescent fixture design. His conclusions and recommendations were based on "three years of continued, extensive (tho at times hysterical) use of fluorescent lighting."

An intelligent choice of lighting systems cannot be made from promotional literature. Greenberg (12) gave a good idea of the complexities of factors and the technicalities involved in making a choice between lighting systems. Kilpatrick (21) compiled check charts for small or large installations. He made possible an analysis of the factors involved in the selection of equipment and service and operating costs of different lighting systems.

Maintenance of Equipment

The war brought about a great interest in making things last longer. The slogan "Make It Last," as applied to school lighting, meant greater care of lighting equipment, and much has been written on this subject. The consensus on this matter was well summarized and diagrammed by Heitzman and Knapp (15). Their graphic story was presented to prove that "maintenance pays dividends in light." They expanded the concept of making irreplaceable equipment last longer and established the economic value of proper maintenance as an all-time basic factor in its own right. Further evidence on the big dividends paid on lighting maintenance, based on operational history, was presented by Bursch and others (5).

General Conclusions

1. Brightness, brightness contrast, and brightness ratios finally have become generally recognized as the prime factors in adequate illumination.

2. The accent on brightness ratios has resulted in the recognition of the need for lighter colored chalkboards, furniture, woodwork, floors, and equipment in school-rooms.

3. Properly controlled bilateral and clearstory lighting systems are making possible new classroom designs.

4. Daylight control by orientation, incorporating roof-overhangs, or light louvers constructed as permanent fixtures in the building design is favored over manually operated blinds and shades.

5. The foot-candle as a factor in illumination now is considered a part of the larger factor of brightness.

6. A fifteen foot-candle level is becoming established as the minimum desirable light intensity for classrooms. The trend is toward higher levels but the first big job is the elimination and replacement of lighting installations providing three or less foot-candles.

7. Fluorescence is becoming one of the major light sources and as such should be installed according to the specifications of a qualified illuminating engineer. Naked fluorescent lamps are undesirable for lighting any space used for critical seeing-tasks. First costs and maintenance problems are the two main factors retarding the installation of fluorescent lighting systems in schools.

8. Luckiesh (25) is the best single source of information now available for those wishing a comprehensive background in the field of light as related to vision and seeing.

Needed Research

1. To develop and make available in quantities an instrument by which brightness can be measured objectively and simply.
2. To establish scientifically defensible brightness standards for comfort and visibility.
3. To establish technics for the proper installation of fluorescent lighting systems and to simplify their maintenance problems.

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CHAPTER IX

Heating and Ventilating the School Building

PAUL W. SEAGERS

THERE HAS BEEN little recent research in school heating. The low temperature panel-sealed heating system is considered desirable in theory with scanty evidence of its being practical at this time.

Ventilation

Likewise there has been very little recent research on the over-all ventilation of school buildings. However, intensive studies have been made on some phases of ventilation. The quantity theory (diluting the air in the room with 30 cubic feet of fresh air per minute, thus requiring mechanical ventilation) was based upon experiments by Pettenkofer in 1863. It has now been generally discarded in favor of the comfort and health theory which, according to C. E. A. Winslow, embraces atmospheric quality and thermal balance of air.

Atmospheric Quality

The 1943 *Heating, Ventilating and Air Conditioning Guide* (3) listed the normal concentration of dust and the present accepted standards for toxicity of gases and vapors in the air. Yaglou and Wilson (1) found that "passing air through commercial filters reduces substantially its bacterial content." This method, however, did not affect the bacteria introduced into the room by means other than fresh air except as recirculation was used. Wells (10) found in his experiments with ultraviolet irradiation at the Swarthmore and Germantown schools that "epidemic spread of childhood contagion in irradiated classrooms during winter months appears to have been checked, while measles, mumps, and chicken pox prevailed during the same period in unirradiated classrooms in these schools and nearby primary schools." The continuance of Wells's studies and those now undertaken at Cato-Meridian, Port Byron, and Mexico by the New York State Departments of Health and Education (9) were designed to find out if irradiation were more effective than dilution of air in providing freedom from air-borne infection. Masterman (1) has been using the aerosol sodium hypochlorite while Robertson (1) has been studying the effects of the aerosol propylene glycol upon air-borne diseases. Studies made by Yaglou and Wilson (1), as well as those made by Winslow and others (11), showed that the use of ozone was undesirable. Winslow (11) also concluded that ionizing the air in a room contributed nothing healthful.

Thermal Balance

The American Society of Heating and Ventilating Engineers (3) determined that during a heating season the room air velocities should not be in

excess of 25 to 30 feet per minute and during a cooling season not more than 40 or 50 feet per minute. Similar conclusions were drawn by Winslow (11). Jordan (5) determined the diffusion of air at various temperatures and introductory velocities. The *Heating, Ventilating and Air Conditioning Guide* (3) included an effective temperature chart designating a comfort zone for the cooling season and another comfort zone for the heating season. Winslow (11) designated an operative temperature because humidity, which is considered in effective temperature, cannot be controlled in extreme temperatures. The American Public Health Association (2) indicated that the foot level in a room should be as warm as the head level. The work of Houghten and McDermott (4) on body radiation to cold surfaces, altho one of the older studies, should be considered here because of its influence on the proposed new type panel heating. Yaglou, Riley, and Coggins (12) found that the odors given off by pupils were influenced greatly by their socio-economic status; thus the amount of fresh air necessary for the removal of these odors was determined for the several socio-economic levels.

McGrath (6) indicated that if the ventilation and heating of a building were zoned according to exposures rather than sections and wings, the troublesome effects of infiltration could not only be overcome but perhaps utilized to a great degree. Nelson and others (7, 8) studied the position, types, and performance of ducts and stack heads.

Once educational research has determined the conditions necessary for comfort and good health at school, engineering research will provide the type of equipment to obtain those conditions. The question of window ventilation versus mechanical ventilation will probably be determined in terms of specific rooms and buildings rather than by a general rule, as orientation, wind velocities, and types of construction and use vary so greatly.

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CHAPTER X

Trend in Materials and Design

REGINALD E. MARSH

THERE HAS BEEN a big improvement in materials and equipment during the past three years due to their need for war purposes. On the other hand, there has been a tendency to overemphasize the development of new materials for postwar construction, particularly by manufacturers in their efforts to keep their names and products before the eyes of the public. This has been unfortunate because it has created in the minds of those who would like to plan for postwar construction a fear that any plans and specifications prepared now would be obsolete by the time construction can be started, because of the wonderful new products prophesied for the future. Those in a position to know have recently made an effort to discount such views and to bring the true facts to the attention of the public.

Wartime restrictions have limited the use of construction materials for those items determined as nonessential. The vast majority of projects constructed during the past three years have consequently been of a temporary character, and little can be gained from a review of these buildings. It is interesting to note, however, the opinions of various writers who are in a position to visualize future construction methods and materials toward which there appears to be a definite trend.

It would appear that Nichols (24) covered the subject about as comprehensively as any other writer. He concluded that there will be few, if any, new materials which will affect the designs of our buildings and no new construction methods which were not used before the war. There have been refinements and developments of old materials and technics. He discussed lighting, heating and ventilating, plastics and laminated wood, particularly the resin-impregnated wood.

Childs and Smith (4) referred to plywood, plastic, and aluminum as "new materials" to be used to provide more livable, sanitary, and cheerful classrooms. Control of light by polarized glass was suggested to eliminate headaches. Development of plastic, asphalt, and rubber for more durable and more easily maintained floors; acoustic material for lessening the noise nuisance; use of wallpaper and redecoration of classrooms from year to year were also mentioned. In the mechanical branches, they expected the practical development of fluorescent lighting to provide sunlight on cloudy days; radiant heat, air conditions, and the substitution of electrical units and window ventilation to supersede the expensive central ventilating systems.

Hacker (14) claimed new materials will be evolutionary rather than revolutionary. He described a new method of treating aluminum for ornamental use which will prevent discoloration and referred to a new development in brickwork to provide leak-proof walls.

The field of plastics seems to hold the interest and fires the imagination of laymen, as well as professional men. Even at their present stage, plastics are only beginning their career. The multitude of chemical compounds yet to be discovered, investigated, and perfected is actually beyond the imagination. But, while enthusiasm is justifiable, it must be tempered with realism. Like all other structural man-made substances, plastics have limitations.

Plywood is another product which appears to have great future possibilities. The scarcity of lumber, however, may have some effect on the development and use of this material in the immediate postwar period. Nevertheless, research and experiments continue, and many new treatments are being discovered. For instance, a treatment is being perfected which will provide a triple protection against decay, termites, and fire. The use of special resins under high frequency heat treatment has opened the door to greater use of wood, both for structural and finishing purposes. Bonded metal plywood has passed thru the experimental stage. New metal alloys have been developed during the war, particularly with aluminum, which will not only permit but demand increased use of these metals for both structural and finishing materials.

There will be increased use of acoustical materials. Insulated glass, consisting of double and triple panes with dehydrated air sealed in between, and increased use of glass blocks are also developments which, along with the plastics, plywood, and metals indicate the trend not only of construction methods but design as well.

All the above mentioned materials are not new materials but are improvements of existing materials. Nothing has been developed recently which would even slightly affect the basic construction methods and materials such as concrete, brick and tile masonry, wood, and structural steel in various forms. It is obvious, therefore, that the trend in future school building construction will be toward simplification and greater use of the improved products developed as a result of war necessities.

Engelhardt (7) believed that the war would sweep away many harmful controls on the production of materials and a great number of new products would be developed. In order to regain their prewar status, building material manufacturers will be back on the market with improved materials at lower cost.

Burkett (3) warned that the architect must be given encouragement to take advantage of technological developments and not be limited to some particular style of architecture. Otherwise he will not be able to solve successfully the school building problem.

Adkins (1) cites the advantages and disadvantages of radiant heating. Palmer (26) warned against adoption of panel (radiant) heating without complete data on costs and efficiencies as compared with present accepted types of heating and particularly ventilation, which must not be forgotten. He also believed that new materials and methods of construction will follow an evolutionary process and extravagant claims regarding new products should be discounted.

Battista (2) claimed that plastics will undoubtedly become the most versatile of man's primary construction materials because they are man-made and the variety is unlimited. Consequently, there will be many applications of plastics in future school buildings. He referred to the use of so-called "penetrating heat" for plywood. O'Connor (25) discussed thoroly the various types of plastics and their uses.

Neutra (21) felt that new methods of joining the framework of finishing surfaces and of installing appliances would modify layouts and designs. Future school buildings will include illumination by day and night, apparatus for television and broadcasting, and acoustical and visual devices. Present products will find broader applicability because of their use in war industries, such as paints and coatings, plastics, new metal alloys, diatron composition, temperature insulating panels, and plywood.

There will undoubtedly be a number of improvements in electrical devices. For instance, a germicidal lamp has been developed which, it is claimed, duplicates certain characteristics of interstellar sunlight and can be used for the purpose of disinfecting the atmosphere and thereby providing the equivalent in a classroom of approximately sixty changes of air per hour. Fluorescent lighting is still in the developmental stage and its suitability for classroom lighting remains to be demonstrated altho the cold cathode type holds out possibilities of an ultimate solution.

Design

The past three years have been practically destitute of new schoolhouse construction due to restrictions imposed by the need of construction materials for war purposes. Consequently, there have been comparatively few recently built schools publicized, other than those constructed to meet the demands of defense and war housing, and the majority of these have been of a temporary nature. However, the impact of the war on the educational needs of the people will have a vital influence on the design, planning, and construction of schools in the immediate postwar period.

Postwar conditions will require more school building for less money. This has been true with wartime schools which were built to provide for temporary accommodations. Engelhardt (9) noted that safety and sanitation have been stressed in the past, together with concentration of school building spaces and designing of architectural monuments, and prophesied that in the future the purpose to which the school is to be put will be the important thing. Mechanistic characteristics will be out, and instead, the social significance of spaces in the school building will be the chief concern.

The consensus is that the trend is toward better schoolhouse design. The question immediately arises "What is a good design and how can it be made better?" Beauty to some extent is a matter of personal opinion and the subject therefore is controversial. In the past history of our country there have been many periods of architectural styles which have reflected the opinion of architect and layman at that particular time. These styles were adaptable to the types of buildings which were erected then, including

schoolhouses. A school building is acknowledged to be a difficult problem from the design standpoint because of the repetitious nature of the units to be incorporated, as well as state requirements and regulations affecting the physical well-being of the child. As schoolhouses became larger and more complex and state regulations more rigid, the exterior design required new architectural treatment, and it is due to these conditions that school buildings are now being streamlined and otherwise depart from a particular period of architectural style. Burkett (3) stated that architecture thruout world history has reflected the life and environment of the nation. In this country our leadership in a great industrial epoch is now beginning to be reflected. The day of individual craftsmanship is past because most materials are machine made. Engelhardt Jr. (10) claimed that school buildings are no longer used to sell communities. Therefore, monumentalism is of no concern to the lay citizen and excessive ornamentation is not wanted. School buildings must be attractive places in which to work as well as attractive to the eye.

Holmes and Shigley (16) foresee school buildings that will be different after the war. The trend is toward simplified design—modern not modernistic—and this trend has demonstrated that beauty in architecture can be achieved thru simplicity of line, plain surfaces, and attractive colors rather than thru ornamentation. In the opinion of Mock and Mock (20), the fundamental characteristic of modern architecture is its treatment of space as flowing and continuous from one room to another and from inside to outside. That is one reason for the use of continuous glass surfaces. The modern school is beautiful because of the bold articulation of its parts instead of being compressed into one massive block, and each element of the building expresses its function thru its form. This allows its adaptation to an irregular site.

According to Lescaze (17) educational programs have progressed far in advance of the planning and designing of school buildings. Consequently we may look forward to improvement. School buildings should be functional as well as beautiful in design. The plan must be free and easy to follow, natural, and economical. Façades should express the plan simply and honestly. There should be a logical use of materials expressive of the plan, native to the locale, and properly arranged. Thompson (31) stated that there are many communities with traditional American architecture which are awake to the need of modern progressive schools, and the architect has the problem of designing a thoroly modern building in such communities. He believes this can be accomplished in various ways so as to effect the appearance of a natural setting and that a homelike character creates a community center which attracts people to it. On the other hand, Schmidt (29) raised the question whether the esthetic is a function of education and whether beauty is an element either desirable or necessary in our planning. Does a beautiful environment further the educational process?

Malmfeldt (18) believed that a fine period of modern architecture will

be developed to express a good plan honestly. Such a plan can be symmetrical or unsymmetrical. Any forcing of a plan to express a particular period style should not be considered. Sibley (30) contended that a school building will steadfastly resist any threat to its expression of beauty altho monumental architecture is not necessary to obtain dignity and beauty without and within. The so-called modern and traditional styles of architecture can be merged into a pleasing expression. Hacker (13) discussed relative costs of the modern and traditional styles of architecture and pointed out that supposed economies are often offset by increased costs not readily apparent.

Construction

According to Power (27) schoolhouses during the war were planned for temporary use. However, some may be in use for many years as these units are quite superior to the portable units used in the past. They have more glass area and are larger. The construction is such that in some cases the best of these temporary structures may be sufficiently permanent to meet all needs and will enable boards of education to make frequent replacements at low costs. They also have the flexibility required for making alterations and additions to meet changes in school needs. In certain locations any other type may be considered too expensive and wasteful from the long term of view. Reid (28) claimed that building economy will require the use of prefabrication for postwar planning of schools. Prefabricated units and products will command wider acceptance because of their quality. This same idea will extend to furniture, equipment, and tools of teaching. Prefabrication will permit fluidity in a building capable of meeting the needs of constantly changing community and regional life. On the other hand, Crawford and Dailard (5) claimed that wartime experimentation with prefabricated demountable school buildings has thus far proved unsatisfactory and has not been of low cost. To be economical, prefabrication requires thousands of identical units and assumes a standardization and rigidity of educational program that cannot exist. Donovan (6) also believed the trend to be toward economy and away from monumental and ideal architecture. Where permitted he recommended frame construction and claimed many advantages for one-story buildings. On the other hand, Hacker (15) insisted that quality will still be demanded to reduce maintenance costs and obsolescence. He called attention to the development of plastics and noncombustible materials, and the trend toward color consciousness.

Architects

Friswold (12) stated that architects must change their viewpoint and philosophy if new developments in design are to be achieved. The same thought is expressed by Reid (28), who claimed that the architect is the key man for design and construction, and he is responsible for resolving the program needs into a well-balanced and well-integrated design. The use

of costly materials and mechanical equipment which sacrifices needed space for educational facilities is a failure of the architect's professional services.

Building Codes and State Regulations

Reid (28) believed that building codes and design standards should be revised to be based on performance standards, because fixed standards of design and layout can do more harm than good. They may be used as devices to avoid creative and independent thinking and are subject to immediate obsolescence. For instance, a fixed area for a classroom is inadequate if it fails to meet the needs of a specific program. The California system of requirements is largely responsible for the development of modern school plant design in that state. Engelhardt (8) stated that regulations have tended to freeze building concepts into fixed molds, but that such standards have been of inestimable value in moving away from stupidity and indifference. Nichols (23) believes that codes should be informative as well as regulatory.

Flexibility

Misner (19) believed that experimental activity programs suggest specialized rooms for preprimary, primary, and post-primary units. The flexible organization in an elementary school must be considered in planning the building. Reid (28) stated that anticipation of change is of the greatest importance and can do much toward postponing eventual obsolescence. The type and use will determine the manner of achieving flexibility. An entire classroom wing may be considered as loft space with interior partitions which can be rearranged. Nichols (22) doubted if movable partitions were the solution because of other conditions such as heating, ventilating, plumbing, and lighting. Friswold (12) referred to multiple use of rooms and equipment and ready extension of the physical plant. Lescaze (17) quoted C. G. Stillman, county architect of West Sussex, England, on his recommendations for providing flexibility of plan of the building as a whole. Evans (11) recommended that spaces should be left free and as unobstructive as possible to provide for both individual freedom and group activity. Since a modern classroom may be in turn a laboratory, a workroom, and a little theater, flexibility is of prime importance. Childs and Smith (4) prophesied that altho built substantially for minimum maintenance, school buildings will be more flexible with demountable interior partitions and standardized units of equipment that may be moved to suit the varying teacher needs and requirements.

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CHAPTER XI

School Plant Operation

H. H. LINN and CLEVE O. WESTBY

THE LITERATURE on school plant operation which has been published since June 30, 1941, is characterized more by the reaction toward the effects of the wartime economy than by any other single factor. This has been evidenced by the many references to shortages in materials, equipment, and man-power. While much of the literature was in the nature of advice and opinion as to how to meet the difficulties of maintaining school plants at a high level of efficiency, many of the articles dealt with specific instances where the crises were successfully met. It may be stated that very little can properly be classed as representative of research. Two general books for custodians were published. Brainard (11) presented the subject briefly but practicably, pointing out how custodians should do their job. Viles (90) covered the field more completely.

Personnel

Selection—Difficulties in attracting qualified men or women to custodial positions have been occasioned by the competition offered by defense plants and other employers, who have been able to pay higher wages than the schools. As a result, standards and qualifications for new employees have been greatly reduced or disregarded. Suggestions for meeting the situation were presented by Akerly (1), Cunliff (22), DeVries (25), Linn (52), *Nation's Schools* (61), and the U. S. Department of Agriculture (89). More women were being employed, and suggestions for extending the use of women as well as evaluation of their service in a custodial capacity were given by Flint (34) and Gibbs (37). Other advocates of more women employees were Linn (52), *Nation's Schools* (61), and *School Management* (79). Brainard (11) and Viles (90) gave in detail their standards to be used in selecting building employees. Sullivan (84) described Boston's civil service plan for schools, which he recommended be extended to custodians. Gillis (39), in a study of custodians in Connecticut, stated that only 57.8 percent were selected by the superintendents. Behn (9) presented an examination developed at the University of Minnesota to be used in selecting building employees. Hynds (44), Kaiser (47), McGrath (53), and *School Management* (79) called attention to the need for more care and higher standards in the selection of new building personnel. Linn (52) stated that many schools were overstaffed because of poor standards of selection, sympathy for aged and incapacitated individuals, and political patronage.

Training—Increased attention was paid to training programs for custodians. Gillis (39) reported that the University of Connecticut provided a free short course to any custodian in the state, but only 12 percent of

the school systems in the state took advantage of this opportunity in 1942. A list of the more noted custodial schools in the United States was given by Linn (52). The growing complexity of the custodian's job was given by McGrath (53) and Olson (70) to show the need for increased training of building employees. Taylor (85) stated that one means of overcoming the serious situation in personnel because of the war was a better program of in-service training. Dolan (26) described the training program at Detroit, and Stoy (83), the in-service program at Denver. A description of the custodian course offered at Kansas State Teachers College was made by Winkel (93). Brainard (11) and Viles (90) stressed the importance of training school custodians, prescribed methods, and gave a list of schools where such training has been held.

Work schedule—That the importance of work schedules is not yet fully appreciated was indicated in Gillis's study (39) which pointed out that 65 percent of the school systems in Connecticut had no work schedules whatsoever. As a means of meeting the building service crisis in wartime, Linn (52) suggested better scheduling with staggered shifts and night cleaning. Brainard (11) presented a model schedule that might be used with slight modification in many schools. Schedules for summer vacation repair and renovating work were suggested by *Nation's Schools* (63) and Robinson (77). The *Catholic School Journal* (18), Cunliff (22), Gillis (39), and Taylor (85) emphasized the need for better planned work schedules.

Salaries—The relatively low salaries paid custodians were given as a principal reason for the dearth of good school building personnel. Olson (70) stated that generally custodians' salaries were not compatible with the responsibility that they must assume. The *Nation's Schools* (61) maintained that the 10 to 15 percent increases generally given building employees during the war period were not enough to offset the effect of competition for workers in industry. Leonard (51) presented plans adopted by a number of cities for stabilized salaries for school employees. The *American School Board Journal* (3) described the schedule of salaries and annual increments adopted by the Canton, Ohio, schools. The same periodical (4) also published the salary schedule for noninstructional employees in use in St. Louis. The American Association of School Administrators (2) and the National Education Association (66, 67, 68) issued bulletins listing the salaries of operation and maintenance employees in the larger cities of the United States. Meisner (55) described a plan whereby school employees were given a bonus of 10 percent to offset the increased cost of living and higher income taxes. The salary schedule of the University of California for nonacademic employees was outlined by Kaiser (47), while Lemmel (50) set forth the plan employed by the Highland Park, Michigan, schools. Cunliff (22), DeVries (25), Linn (52), and Thompson (88) agreed that salaries are too low and that the morale of building employees depends upon their being paid a more adequate wage.

Working conditions—The status of the custodian as a member of the school staff would seem to be in for considerable improvement. The matter of hours, of work, tenure, retirement provisions, sick leave, insurance, and promotion all came in for discussion. Akerly (1), DeVries (25), Grieder (40), and Viles (90) were of the opinion that custodians are entitled to the same privileges of tenure as those accorded to teachers. Linn (52) asserted that custodians are entitled to the same rights as other workers. Clarke (20) urged schoolboards to declare their intentions as far as complying with the Burke-Wadsworth Act in the matter of restoring jobs to draftees when they are discharged from the armed services. Fuller (35) presented an analysis of the status of school employees so far as they are protected under the workmen's compensation laws of the several states. He called attention to the difficulty in interpreting just who is included under such laws and to their lack of uniformity. Gibbs (37) stated that women should not be expected to do work involving heavy lifting and that some provision should be made for rest rooms for them. While retirement provisions and methods of handling retirement funds for nonteaching employees were discussed by Baish (7), Clifford (21), Mohlman (56), and the National Education Association (69), Gillis (39) found that only four out of 169 school systems studied in Connecticut included the building employees in their retirement systems. Gilbert (38) presented the case for social security benefits being extended to all school employees and Mohlman (56) discussed the possibilities of retirement for nonteaching employees under the existing local, state, and federal setups. Hope (42), in his doctoral thesis, offered a detailed plan for the treatment of nonteaching employees that is superior to anything in the field.

Supervision—A comprehensive check list with instructions for scoring service was presented by Viles (90). Winkel (93) described the functions of the traveling serviceman in checking and helping custodians within a large school system.

Dress—That neatness and pride in appearance are indicative of a man's regard for the quality of his work was the opinion expressed by Brainard (11), Thompson (87), and Viles (90). While they were generally agreed as to what the uniform should include, Viles (90) would add a belt with loops for frequently needed tools and a cap to match the uniform. Each of the men gave several reasons why the custodian and the school both would gain by attention on his part to his appearance. Gibbs (37) recommended that women employees also should be provided with a uniform.

Housekeeping

While most articles on the topic dealt with the methods of housekeeping, many others described tools which should speed the custodian in his labors and help him to do a better job. In their books, Brainard (11) and Viles (90) emphasized the necessity for good tools and gave considerable attention to their selection, use, and care. Flikheid (32), in a series of

articles, described brushes as to use and construction, paying particular attention to the different kinds of fibers used. Du Frain (27) and George (36) stated that providing the custodian with good tools not only helped him do a better job but also increased his morale. Davenport (23) reported that the use of vacuum cleaners at Michigan State College had resulted in a saving of 40 percent in sweeping costs in spite of an increase of 67 percent in floor area. Tests there indicated that not only did it take less time to clean a room with a vacuum cleaner, but also a far better job was done. Bowers (10) gave the specifications for a janitor's cart which has spaces for all supplies and tools, containers for sweepings and waste-paper, and which may readily be pushed from room to room.

The *American School Board Journal* (5) stressed the importance of good housekeeping and stated that old buildings without modern features are often more desirable to work in than new ones because of better housekeeping, and that modern gadgets must not be substitutes for good care. Brainard (11), the Seattle schools in their *Custodian's Manual* (80), Viles (90), and Williams (92) treated the subject of housekeeping quite fully. Wilhelms (91) believed that the custodian in his capacity as a housekeeper set a standard for the pupils and as such was an important member of the educational staff. Taylor (85) expressed the opinion that conservation of school buildings and equipment depended a great deal upon the quality of the housekeeping. Theisen and Sutherland (86) discussed housekeeping from the standpoint of its relation to the health of the pupils.

More specific articles included three in the *Catholic School Journal*, one (16) on removing ink stains from the floor, another (13) on cleaning window shades, and a third (19) on the preparation of a furniture polish. Toilet cleaning was treated by Hayford (41) and the *Catholic School Journal* (17). A comparison of common methods of window cleaning and a recommendation as to which would be most advisable in view of the manpower shortage were given by the *Nation's Schools* (65), while suggestions for preventing window breakage were contributed by Payne (73). Details of the construction of a dipping tank and a description of the process of preparing furniture for refinishing by this method as well as an analysis of the cost were set forth in articles by Horn (43) and Joyner (46).

Floor maintenance—No new building and relatively little replacement of floors, coupled with a shortage of many desirable products used in maintaining floors set the theme for most articles in this area. Brainard (11) and Viles (90) devoted a considerable portion of their respective books to the matter of floor maintenance, describing preservation, treatment of old and new floors, the different kinds of seals, waxes, tools, and cleaners. Rudie (78) and a group of experienced building maintenance men pooled their experience in caring for floors and their article must be judged a most practical one. Bailey (6) outlined the steps to be followed in changing from oiling to waxing floors. Ethington (30) listed one hundred ques-

tions on floor maintenance and described a novel method for sealing floors which he claimed to save both labor and materials and to produce a better job. The treatment of gymnasium floors and the prevention of warping was discussed by Hayford (41), while the steps to be followed in making floors and stairs safer were given attention by Brainard (11), Orchard (71), and Viles (90).

Fire Prevention and Other Safety Measures

Special emphasis was placed on the custodian as a safety engineer, pointing out the sources of accidents common to schools, things that he should do to prevent accidents, and rules that should be followed by all. The survey made by Irwin (45) of safety conditions in high-school buildings, gymnasiums, and grounds revealed the fact that much is being overlooked and that some precautions which are taken are relatively ineffective. The prevention of accidents that might be incurred in the course of the routine work of the custodians was noted by Flint (33) and Dench (24) who advocated training in the proper way to perform certain tasks as a means toward this end. The elimination of the fire hazard was quite well covered by Brainard (11) and Viles (90), both of whom also described the several kinds of fire extinguishers and set forth rules for their care. Ledbetter (49) discussed electrical wiring and equipment as potential fire hazards and stated some things which might be done as safeguards. A similar article appeared in the *Nation's Schools* (62). In a series of articles the *Catholic School Journal* (12, 14, 15) reviewed fire hazards and the maintenance of fire-fighting equipment. A check list on safety and fire prevention was offered by English (28).

Painting and Decorating

While many schools have for years had a standard color scheme for all classrooms, Orchard (71) told of the plan used in one system where the experts from a paint company made a survey and recommended certain color combinations which had been tested for illumination qualities and eye comfort. These were then presented to the principal and teachers of each building, who made the final selection. A continuous painting program has been inaugurated at Ironwood, Michigan, and according to Erickson (29) the difficulty of securing a large enough crew to repaint an entire building at one time has been overcome. Two painters were hired on a yearly basis and a schedule has been worked out to enable the painting to go on without interference with regular schoolwork. The desirability of a carefully planned cycle of painting operations was stressed by Siegle (81), while the entire subject of painting and refinishing was treated by both Brainard (11) and Viles (90).

General Maintenance

Roofs and walls—Relatively little was published in educational literature on this phase of building maintenance. Propper (75) discussed the

causes of leaking walls and their peculiarities and warned against over-waterproofing that might cause other trouble. Brainard (11) described the steps in roof and wall inspection and mentioned minor repairs the custodian should be expected to make. In another article Propper (74) gave a comprehensive and practicable list of suggestions on roof maintenance.

Mechanical equipment—As school heating, lighting, and ventilating installations become more automatic mechanically, the greater will be the need for custodians who not only understand how to operate the equipment but also to maintain it. During the war this was demonstrated because of the impossibility of replacing much of the mechanical equipment and of the shortage of experienced men who would normally service such equipment. Four excellent articles by Mosher (57, 58, 59, 60) appeared dealing with the inspection and maintenance of pumps, electrical equipment, piping, and the steam plant. In these he stressed inspection as the means for uncovering defects and precluding costly repairs and breakdowns, and pointed out the fact that the best results can be obtained only if inspection is done according to a schedule devised with respect to frequency with which certain parts are apt to become faulty, as well as the time of the school year. A good check list on motor maintenance appeared in the *Nation's Schools* (64) and one on the important items to note in maintaining heating and plumbing equipment was suggested by Radder (76). Smalley (82) presented a detailed list of points to be observed in caring for scrubbing machines.

The importance of scheduling maintenance operations was stressed by the *Nation's Schools* (64), Siegle (81), and others who presented the arguments that scheduling resulted in the job being done on time, less waste of effort, and in making it possible to have men and materials at hand when needed.

Custodian-Pupil-Teacher Relationships

An unusual number of articles appeared which urged increased cooperation between the pupils, teachers, and custodians in meeting the emergency caused by the war, and emphasizing the need for custodians and other staff members to appreciate the role of the custodian as a teacher, counselor, and public relations agent. *School Management* (79) described how the parents, teachers, and pupils worked out a plan to repaint and repair the school furniture and other equipment at Milford, Massachusetts. Hayford (41) and Park (72) told of methods whereby teachers and pupils could help to conserve school supplies and equipment as well as avoid causing needless work for the custodial staff. A check list for teachers on their success as classroom housekeepers was outlined by Laird (48), while Mason (54) described how students under teacher supervision might even paint a schoolroom. Bassett and Cooper (8) related the details of an effective plan used in a school in the Negro section of Harlem to control vandalism, which incorporated the student council, the school newspaper, the

pupils, teachers, and parents. Hynds (44), Olson (70), Wilhelms (91), and others presented excellent arguments to indicate that vandalism can be greatly mitigated, if not eliminated, thru establishing a better relationship between the custodian and the children. They also stressed the important function that the custodian had the opportunity to perform in the matter of guidance. McGrath (53) presented a good discussion of the relationship that should exist between the custodian, children, teachers, and community. In a chapter on public relations Viles (90) covered these same points quite well.

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CHAPTER XII

School Plant Insurance

NELSON E. VILES

DURING recent years REVIEW OF EDUCATIONAL RESEARCH reports on school property insurance studies have been included under various headings. In 1935 Holy (19) made a comprehensive summary of "Public School Plant Insurance," covering insurance legislation, insurance rates, loss ratios, and state and self-insurance. Since that time partial summaries have been included under various headings in several issues. In 1938 Fowlkes (13) included insurance with purchasing and store management, and Chambers (11) cited some studies under the heading "Court Decisions in the School Plant Field." In 1941 Arnold and Castetter (6) reported a few studies under the heading "Accounting, Reporting and Insurance." In 1942 Brownell and Schwarz (9) reported some insurance studies under the heading "Court Decisions in the School Plant Field." In 1944 Smith (39) listed certain insurance research studies in a chapter on "Principles of Business Administration Applied to Personnel and Other Activities." The importance of insurance in the school administrative program seems to justify at this time a comprehensive report covering the major insurance research studies published since 1935.

Need for Property Protection

Recent studies in school plant insurance have generally supported the theory that school officials are obligated to protect the district's property investments. The *Nation's Schools* (49), Babson (7), and the *American School Board Journal* (2) cited large annual school fire losses as an indication of need for such protection. Hope (22) indicated that South Carolina district valuations would not support bond issues sufficient to replace buildings lost. Roberts (37) termed the purchase of insurance good district business and the *American School Board Journal* (1) reviewed a committee report of the New York State School Boards' Association which termed school property insurance essential. Werner (51) found that court decisions uphold the authority of schoolboards to purchase insurance protection.

Fire Losses and Insurance Rates

The fire loss ratio or the relationship between premiums paid and loss indemnities received, reported in some detail in 1935, again was the subject of several studies in the 1935-1944 period. Some of the studies made during this period were limited in scope or covered loss experiences of insufficient duration to serve as a basis for determining whether insurance rates are too high or too low. However, most of the studies did show a wide margin between the premiums paid and the loss indemnities returned to the schools. Lewis (29) reported a loss ratio of 41 percent over a ten-year period in

Arkansas; Rogers (38), a 47 percent loss ratio over a five-year period in Texas; Steinhauer (40), a 36 percent loss ratio over a period of eleven years in Pennsylvania; and the *Nation's Schools* (48), a 22 percent loss ratio over an eleven-year period in one state. Werner (52), in reporting a 31 percent loss ratio in Pennsylvania, concluded that school insurance is good company business. Likewise Holy (18, 20), in reporting a loss ratio of less than 13 percent for two cities, concluded that commercial insurance rates on school buildings should be reduced. Roberts (36) found that, even tho insurance rates on school buildings had been lowered since 1930, there had been a decrease in losses and as a consequence the percentage of the premiums retained by the companies was as large as during the previous decade. The Arkansas State Department of Education (5) concluded that school fire insurance rates were excessive in that state.

In a related area *Public Management* (33) and Mallery (31) reported low loss ratios on municipal properties. However, Dauwalter (12) denied that rates on municipal buildings were excessive and the *American City* (45) reported that in seventeen out of twenty midwestern cities, rates on public property were lower than those on private property.

Administering the Local Insurance Programs

Many school officials are not familiar with basic insurance principles and practices and the local programs are often planned by resident insurance agents, who in this capacity must attempt to serve both the client and vendor. Vestal (50) found a lack of uniformity in school insurance practices. Grimm (16) concluded schoolboards should purchase, not be sold, the insurance protection needed. The *American School Board Journal* (1) stated that the school insurance program should be carefully and economically planned. *Public Management* (33) recommended complete insurance records and accurate data on coverage and property values. The use of riders to adapt standard policy forms to school needs was recommended by Grimm (16), while the *American City* (47) contended that requiring insuring companies to replace partial losses would save time for the district.

Little attention was given to the question of mutual insurance for schools. Werner (51) found some court decisions supporting and some opposing mutual contracts for schools. In a survey of Kentucky court decisions on school insurance Gruelle (17) concluded that mutual contracts in that state do not involve district credit, and that in Kentucky school districts may become members but not stockholders in mutual associations.

Following plans outlined by the writer and others in studies reported by Holy (19) in 1935 substantial savings have been made in local insurance costs thru the elimination of fire hazards, co-insurance contracts, and the use of term policies. Burkhardt (10) reported savings of 70 percent and Roberts (37) of 56 percent. Likewise, Anderson (3), Garver (15), Hunn (23), Mallery (31), and Rogers (38) reported savings from studies of local rates and the removal of rate penalties. Stone (42) recommended a new rating system based on risk and the individual district loss experience.

Evaluating Property to be Protected

Insurable values are determined by making certain allowable deductions from the present worth, which should represent present replacement cost less depreciation. Steinhauer (40) found that many schoolboards make little effort to determine property values but permit local insurance agents to estimate the coverage to be written. Grimm (16) and Joyner (27) concluded that local boards should maintain accurate property value records. Reger and Brake (34) contended that technical engineering service is necessary to establish values and to reduce costs, but Roark (35) concluded that the insuring companies should help establish values. Barker (8) recommended the use of indexes of construction costs as a means of determining values. Garver (14) termed appraisal the first step in the program and deemed local estimates ample for insurance purposes. Likewise, Nibecker (32) found local estimates acceptable. He recommended up-to-date inventories of all equipment.

Purchasing Insurance Protection

Distribution of the insurance business among local agencies and the selection of insuring companies from whom to purchase protection continued to be problems in many school districts. Jenkins (24) recommended purchasing all coverage from one company and thru one agency. Garver (15) recommended frequent checks on the stability of insuring companies and Joyner (28) used scope of business, surplus, capital, and liquidity of assets as criteria for evaluating financial stability. Purchase of insurance thru brokers was recommended by *Public Management* (33) while Suffield (43) proposed an association of local agencies each sharing in the profits even tho the coverage be written thru only one agency.

These studies showed a wide variation in the amount of coverage written. The Arkansas State Department of Education (5) found that 2121 out of 5497 buildings carried no coverage, and Lewis (29) reported one Arkansas county with no coverage. Lura (30) reported 589 fire loss cases with only about 55 percent of the loss protected. Roberts (36) reported a coverage of about 70 percent for 9296 city school buildings. Garver (15) recommended a coverage of 80 percent and Barker (8), 100 percent of the insurable value.

Self- and State Insurance

In an attempt to reduce the spread between insurance costs and returns several studies were made on the feasibility of and experiences in state or self-insurance for school property. Some of these studies were comprehensive and others were limited in scope and the length of loss experiences. In a few cases conclusions seemed to have been reached without having evaluated all of the administrative problems involved. None of the studies gave much attention to one of the major overhead costs in school insurance costs, that of local agents' commissions. However, these studies do show a

trend in thinking which should be pursued until the problem of public versus commercial insurance protection for public buildings is brought to a solution.

Holy (20, 21) reported that state insurance programs in North Dakota, South Carolina, and Wisconsin were saving money for the schools and estimated that state insurance in Ohio could save the schools at least \$300,000 per year. Anderson (4), in a Georgia study, and Vestal (50), in a Texas study, concluded that state insurance would effect substantial savings in these states. In a more conservative statement Roberts (36), in reporting to the National Association of Public School Business Officials, recommended that schools study the feasibility of self- or state insurance.

Approaching the problem from another angle, Steinhauer (40) concluded that school districts in Pennsylvania could profit by forming a cooperative insurance association to operate on a loss protection basis. Gruelle (17) concluded that state underwriting costs need not exceed 5 percent and compared this with 46 percent for stock companies.

Joyner (28) and the *American City* (47) set up certain criteria such as the number of risks and ample reserves properly protected for the development of self-insurance programs. Joyner (28) did not recommend self-insurance for small districts. Stevens (41) contended that if a state provides insurance service it should accept the accompanying obligations of the protection of funds and the equalization of risk. The *American City* (44) recommended a program of rate reduction rather than the use of self-insurance.

Summary

Recent studies indicate a feeling that school insurance costs are excessive and a desire to effect a change either thru rate reduction or some form of self- or state insurance. Some of the studies indicated a felt need for more state department of education assistance in insurance studies. There seemed to be a general feeling that local district insurance administration should be improved and that local costs could be reduced.

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CHAPTER XIII

Financial Aspects of the School Plant

WILLIAM R. FLESHER

IN PREVIOUS ISSUES of the REVIEW OF EDUCATIONAL RESEARCH dealing with the school plant, reported research in the area of school finance has been limited largely to that dealing with school building costs. That the financial aspects of the school plant either merit more careful consideration or comprise a growing area of research, or both, is evidenced by the fact that in each succeeding cycle of the REVIEW greater prominence has been given, in the issue devoted to the school plant, to a discussion of research in the field of school finance. In the first cycle, research on building costs was included as only a part of the chapter on school buildings (18). The issue on school plant in the second cycle confined research on building costs to the relation of type of construction and material to the original cost, maintenance, and operation of school buildings (22). In the third cycle an entire chapter was given to research on school building costs (6). The fourth cycle included not only a chapter on building costs (11) but also a short chapter on financing building by the sale of school bonds (5).

The plan of the present chapter, in this the fifth cycle, is to combine in one chapter research on school building costs and methods of financing school building construction. This combination and expansion, however, still exclude research on costs for maintenance, operation, and insurance of school plants and trends in construction costs due to changes in design or material.

Generally speaking, in the triennium since 1942, little true research in the area of school finance is evident from an examination of the literature. Especially is this true with respect to unit costs of building and division of costs among the major phases of school building construction.

The School Plant of the Nation

Table I, compiled by the author from the most recent statistics reported by the U. S. Office of Education (26), gives an over-all picture of the school plant in continental United States as of 1940 with comparative data for 1938. The Office of Education reported increases during the three-year period in the total value of the school plant and in the value per pupil enrolled. It reported small decreases in total public-school enrolment and number of school buildings, a larger decrease in the number of one-room school buildings, and a very marked decrease in the percent that capital outlay was of the total current expenditures.

TABLE I
Financial and Other Related Data Concerning the School Plant of Continental United States, 1940-42

<i>Item</i>	<i>1940</i>	<i>1942</i>	<i>Percent of Change</i>
Total public-school enrolment	\$ 25,433,542	\$ 24,562,473	-3 4
Value of public-school plant:			
Total	7,635,112,546	7,801,417,262	+2 2
Per pupil enrolled	300	318	+6 0
Number of school buildings	226,762	222,660	-1 8
Number of one-room school buildings	113,600	107,692	-5 2
Percent of annual expenditures spent for capital outlay*	11 0	5 9	-49 4

* Current expense, interest, and capital outlay; but excluding bond and short-term debt payments.

Extent and Cost of School Building

No research is needed to discover that school building construction in the last two years has been greatly curtailed by government restrictions on critical building materials. Table II, compiled by the author from *Bruce's School Market Letter* (7, 8), presents certain data on the extent and cost of building contracts let from January 1941 to July 31, 1944, as well as the school bond sales during that period.

TABLE II
School Bonds Sold and Contracts Let, 1941 to July 31, 1944

<i>Year</i>	<i>School Bond Sales</i>	<i>Contracts Let</i>		
		<i>Number of Projects</i>	<i>Square Feet</i>	<i>Value</i>
1941.	\$59,471,053	4,046	27,001,000	\$151,195,000
1942.	14,790,036	4,550	31,584,000	152,451,000
1943.	13,220,369	2,973	16,043,000	56,758,000
1944*	15,801,800	2,138	6,728,000	48,667,000

* First seven months of 1944.

Some school building construction has taken place under provisions of the Lanham Act—Public Laws 137 and 409, enacted June 1941 and January 1942. This act provided for federal assistance to defense areas, including assistance for the construction, repair, equipment, and operation of school buildings. Alves (1) reported that by January 31, 1942, Presidential approval had been given to 276 applications for buildings under provisions of the Lanham Act. Edgar (9) found that the 290 applications given Presidential approval by March 1, 1942, under this act, called for a total expenditure of \$42,913,113. Thurston (24) reported that by June 30, 1943, \$142,000,000 had been spent on new buildings and remodelings under the Lanham Act.

Building Cost Indexes

Barker (4), using 1926 building costs as the base, computed that the building cost index for 1942 was 120.22, the highest in the period from

1926 to 1942, inclusive. He reported also that building cost indexes had been fairly constant (approximately 106) during the three-year period from 1937 to 1939 but had risen to 109.64 and 114.32 for 1940 and 1941. Indexes were lowest since 1926 in 1932 and 1933, being 76.2 and 79.9.

The psychological advantage and the financial error of voting bond issues and constructing buildings during periods of economic prosperity were pointed out by Hamon (16). Using 1913 as the base year and translating national capital-outlay figures into indexes, Hamon reported that the peak year of school building (capital-outlay index of 458.1) was 1925 when the construction cost index was 208, or only 43.2 below the highest construction cost index since 1913.

Unit Costs

Research on unit costs has been rather negligible. Holter (17) reported a cost of approximately thirty-four cents per cubic foot including the cost of equipment for a school plant completed in 1940. A Rhode Island high-school building was completed at a unit cost of forty-six cents per cubic foot including equipment, grading, and architect's fees (3).

Division of Costs

This is another area with a lack of research. Bits of data are available for individual cases. Fawcett (12), for example, reported the following percentage division of costs of three elementary-school buildings in Ohio in 1941: general construction, 71 percent; heating and ventilating, 15 percent; plumbing, 6 percent; electrical work, 8 percent. As a second example, an Ohio high school was reported (2) built with 74 percent of the total expenditures going for general construction, 15 percent for heating and ventilating, 5 percent for plumbing, and 6 percent for electrical work.

Methods of Financing School Plant Construction

Sale of school bonds continued as the major method of financing school building programs. *Bruce's School Market Letter* (7, 8) reported a marked decrease in the sale of school bonds since 1941. (See Table II.) The amount of school bonds sold during the first seven months of 1944, however, was greater than for either of the entire two years preceding. Grieder (15) pointed out that financing building by issuing bonds is very costly but predicted that its use would continue for some time, because state governments apparently are not yet ready to enter into the financing of school plant construction to a very marked degree. He pointed out further that very little research had been done and very little had been written concerning school bonds since 1935. He presented seven steps to be taken by boards of education and school administrators preliminary to submitting bond issues and gave ten principles to be followed in administering an approved school bond issue.

Flesher (13), in a study of support of financial proposals in Ohio from 1928 thru 1942, found that:

1. Sixty percent of the bond issues and 80 percent of the school levies submitted were approved.
2. The most favorable time for submitting bond issues was at special elections; the least favorable time at general elections.
3. School levies were given most favorable support at general elections and least favorable at primary elections.
4. Forty percent of the bond issues which failed to carry and were resubmitted in the same calendar year passed.
5. Approximately two-thirds of failing school levies passed on resubmission in the same calendar year.

Use of Federal Funds for Building

Alves (1) reported that as of January 31, 1942, of the 1141 applications for federal aid for school building under the Lanham Act, 569 had been given "certificates of necessity" by the Defense Publics Works Division of the Federal Works Agency. Of these 569, Presidential approval had been given to 287 applications. Edgar (9) stated that the approximately 290 approved applications called for the use of approximately \$35,000,000 of federal money. Of the \$142,000,000 spent by June 30, 1943, under the Lanham Act for new and remodeled buildings, Thurston (24) reported that \$66,000,000 was federal money.

Joyal (19) stated that from 1933 to 1939 the Public Works Administration had assisted in the erection or alteration of 12,702 school buildings, for which \$574,632,578 were allotted by PWA.

Publicity for School Financial Support

Edmiston and Holcomb (10) studied the number of column inches of newspaper publicity in connection with thirty-eight proposed bond issues submitted in Ohio cities from 1937 to 1939. They reported that:

1. Issues approved averaged more newspaper publicity than those which failed.
2. Editorials, practically a necessity for the success of an issue, were the most effective type of newspaper publicity.
3. When adverse publicity approached or equalled the amount of favorable publicity, the bond issue failed.
4. Accompanying bond issues lessened the chances of approval for the school issue.
5. To succeed on resubmission, even greater newspaper publicity was necessary.
6. Special elections were the best time to submit bond issues.

Shibler (23) reported the passage, by a 75 percent majority, of a special school levy which had failed the year previous by a vote of two to one. The technic used was to prepare alphabetized lists of voters, all of whom were contacted by parent-teacher association committees, and to hold six public meetings in addition to sending letters to parents.

School Building Needs

Fowlkes (14) reported that at least \$5,000,000,000 would be needed after the war for the repair of old and the erection of new school buildings.

He based this estimate on the assumption that reorganization of local school units would be effected. The National Resources Planning Board (21) indicated that probably one-half the pupils below college grade are now housed in school buildings that are obsolete or poorly located. It predicted that there should be spent each year, for a five-year period, at least \$1,860,000,000, to provide building sites and equipment for a justifiable minimum educational program for children below college grade.

Winston (27), in a study of needs for new elementary- and high-school buildings in thirty-six states, found a reported need in 1943 for 3199 new buildings and 2007 additions to buildings already constructed. The estimated cost of the new buildings was \$321,076,013 for sites, buildings, and equipment, and \$106,436,561 for additions. Thurston (25) predicted that \$2,500,000,000 would be needed to catch up on school plant construction. He pointed out that the school district indebtedness in the two-year period ending in 1942 had decreased 8 percent in the United States.

Lewis (20) predicted that there will be need for federal assistance in school building programs in the postwar period. He pointed out, however, that the whole problem of federal support was dependent upon a sound economic system. He feared that the high national debt may cause opposition to increasing federal expenditures after the war.

Needed Research

When one considers the investment that the public has in the school plant of the nation and the amounts required annually for replacements and repairs, it is somewhat astounding that so little research on these phases of school finance has been carried on. The present period of limited building offers a splendid opportunity, and should provide an incentive for research in school building costs in order to make possible wiser school plant planning and execution of plans in the postwar period.

The greatest lack of research appears to be in the areas of unit costs and division of costs. Certainly there is need for research also on the interest costs of financing construction thru the sale of school bonds. A rather high percentage of the final cost of buildings financed in this manner, undoubtedly, goes for the payment of interest charges. Obviously this money could be spent to better advantage on other phases of the educational program.

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CHAPTER XIV

Legal Aspects of the School Plant

JOHN H. HERRICK

THIS CHAPTER is designed to cover the literature dealing with the legal aspects of the acquisition, use, and disposition of school buildings, school grounds, and school plant equipment. There are, however, certain omissions that should be noted. A number of magazines, such as the *American School Board Journal*, publish regularly brief paragraph summaries of current court decisions, and others, such as the *Journal of Negro Education*, publish longer discussions of single cases. These are essentially news items. There are also numerous signed magazine articles dealing with one or more cases in a fashion that is primarily reportorial. There are undoubtedly research technics involved in preparing these materials for publication. However, the decision in a given case is so often dependent upon the statutes of the particular state or upon the particular facts of the case that the reporting of cases without generalization represents incomplete research and might properly be thought of as providing raw materials for research. These several types of articles are, therefore, generally omitted from this review.

The liability of the school district for its torts and those of its employees is the most discussed subject within the scope of this chapter, and there are many articles in the legal periodicals which deal in a general way with governmental tort liability. Since there is much material in the educational literature, the articles in legal publications are omitted unless they bear directly on school matters or bring out some aspects of the general subject not well covered in other sources. Anyone wishing to study fully the subject of school district liability will find it helpful to examine these general articles, all of which may be located under the topic of "torts" in the *Index to Legal Periodicals*.

While buses and other vehicles might be brought within a definition of school plant, the literature dealing with them has not been included in this chapter.

An outstanding event in this field in the past three years is the publication in 1943 of Volume 47 of *American Jurisprudence* (14), which includes a concise summary of the law on all phases of school operation. The generalizations are carefully stated and well documented, and this volume might well be the starting point for more detailed investigations of specific aspects of school law.

Nature of School Plant

As a general rule, the location of school houses is left to the discretion of the local board of education, altho there are in some states statutory restrictions as to surroundings or accessibility (14). Rockwell (19), in a study of school plant sanitation, found that eight states required approval

of the site by some agency other than the board of education and that five states had statutory restrictions as to type of site.

Rockwell (19) also discovered from his analysis of statutes that a majority of states require some approval of plans by an agency other than the board of education or the establishment by the state department of education of rules and regulations concerning plans and specifications for school buildings. Sanitary inspection of school plants and the correction of unsanitary conditions were also found to be required in most school codes, but mention of the purity of drinking water was found in the laws of only twelve states.

The power of boards of education to provide gymnasiums, athletic fields, and playgrounds has been upheld in many cases (10, 14), and the land used for athletic or play purposes need not be contiguous to the schoolhouse site (14). The right of the board of education to provide and operate school lunchrooms has been upheld (10, 14), and in some cases the authority has been implied from the power to control instruction (14).

The Research Division of the NEA (13) published brief summaries of cases in six states upholding the legality of public-school use of parochial school buildings, except that the ruling in Iowa was reversed in 1918. Rosenfield (21) referred to cases in nine states where such arrangements had been held unconstitutional, and to cases in Indiana and North Dakota where they had been upheld. The apparent contradiction between these authors is due to their use of different cases, altho the reader gets the impression by not unreasonable inference that each author had examined all pertinent decisions. The general rule, as stated by *American Jurisprudence* (14), is that the use of sectarian property is legal unless the arrangements are such that more or less religious instruction in the tenets of one denomination is necessarily involved.

In the absence of constitutional or statutory provision to the contrary, the general rule has been held to be that a board of education may not establish separate schools for white and colored pupils irrespective of the relative quality of instruction (14).

Oakes (14) stated that the construction of schoolhouses must usually conform to the requirements of city building codes or other valid police regulations.

Both Yakel (28) and Owen (15) reported that boards of education in Oklahoma have, under their authority to erect school buildings, an implied power to equip the buildings out of taxes levied for their construction. In Texas this general authority has been construed to authorize the erection of teacherages. It was also stated that the general rule is that boards of education have power to provide necessary apparatus and equipment, subject to statutory limitations (14).

Use of School Property

Several authors (2, 6, 10, 11, 14) summarized cases involving the use of school buildings for nonpublic school purposes. Great divergence of

opinion among courts in various jurisdictions was revealed in respect to the use of public-school property for private school purposes, for religious uses, and for entertainments and other community functions. Hamilton and Mort (10) and Oakes (14) observed in the court decisions a tendency toward liberality in the uses to which school property may be put. However, even where liberal use has been allowed, there must be no interference with the use of the property for regular school purposes (14). Chambers (5) reported that a California statute had been held to make it mandatory that school buildings in that state be made available as civic centers for use by various organizations.

Harrington (11) analyzed rules and regulations of boards of education as well as other legal materials, and found that local school authorities do not interpret very liberally the permissive statutes in respect to nonschool use of buildings. Local regulations often frown upon political meetings, dances, religious activities, and commercial or advertising uses. They are relatively liberal in allowing free use of school property to school organizations and other groups of educational character.

Financing the School Plant

Boards of education have no inherent power to levy taxes (10, 14, 15), nor can a grant of such power be implied from a statutory grant of authority to establish and maintain schools (10). The power of taxation is conferred upon boards of education by statute. In the exercise of this power, the procedures outlined in the statutes must be followed, altho the courts will usually overlook irregularities which are minor and which do not deprive the taxpayers of some substantial right (10).

A tax which has been approved by the voters cannot be extended to territory which has come into the school district subsequent to the election, if the constitution requires the consent of the voters to the tax. In the absence of such constitutional requirement, the tax may generally be extended to the added territory (14). The power of a board of education to borrow money is likewise acquired only by legislative enactment, and the provisions of statute are strictly construed (10). Debt limitations are absolute and cannot be evaded by any lease and option device (14). A lease with right of purchase is, however, legal if it does not constitute a purchase on the instalment plan in violation of a debt limitation (14). A contract in excess of the debt limitation is void, but it is enforceable up to the debt limit and invalid for the excess, whether the contract is severable or not (14).

Hamilton and Mort (10) reported lack of agreement among the courts as to what constitutes debt in interpreting debt limitations, and expressed the opinion that the better rule is that assets should not be deducted from the gross amount of debt. Accrued interest is debt, but future interest and contracts for future delivery of and payment for supplies as needed are not debt within the meaning of debt limitation statutes (14).

If bonds are invalid because of lack of authority to issue them, the bondholders may recover the unexpended portion of the money and any property purchased with the proceeds, if the property can be clearly identified as purchased from the proceeds of the bond sale and if its recovery will not seriously injure other property of the school district or disrupt the orderly management of the school (10).

The effect of boundary changes on the responsibility for unpaid debt is often governed by statute, and the legislature has plenary power in the matter (14). In the absence of statute, the general rule is that the debt remains on the original district, altho title may pass to the new district (10, 14). However, Oakes (14) pointed out some exceptions in instances where entire districts were merged.

Hamilton and Mort (10) reported cases in which statutes holding the remainder of a district liable for the payment of bonds were declared to be unconstitutional because they involved impairment of contract.

Taxation of School Property

Owen (15) reported two cases consistent with the general rule that public-school property is exempt from taxation by other subdivisions of the state, but is liable to assessments for paying and other improvements.

The Research Division of the NEA (13) published a compilation of the constitutional and statutory provisions regarding the exemption of private schools from taxation and stated that such exemptions were generally sanctioned by constitutional provisions. Witkowiak (27) reviewed two old decisions of the U. S. Supreme Court holding that such exemptions were contractual in nature and could not be abrogated by subsequent constitutional or statutory changes. Chambers (4) and Witkowiak (27) reported decisions holding that tax-exempt institutions are subject to pay taxes on property not actually and physically used for educational purposes.

Title to School Property

Johnston (12) pointed out that the ownership of school property, but not necessarily the title thereto, is in the state, and that the title to such property can vest in any person or persons designated by the state legislature to act as trustees. The legislature may transfer title without consent of the local school district, except that in so doing there must be no invalidation of contract in any trust that may be in effect (14).

In the absence of statutory restriction, a board of education may take title in fee simple (14). In case the property is taken by eminent domain, fee does not vest in the board of education, but only the right to occupy and use the property for school purposes is acquired (14).

Boards of education have a clear right to acquire property by eminent domain, including property for playground space, but in the absence of statute, property already devoted to public use may not be taken for school purposes (14). School property, on the other hand, may be taken for other public uses (14).

Edwards (8) and Oaks (14) discussed the general rule that reversion is not favored by the courts, and pointed out that the courts will construe a deed strictly against reversion unless the terms thereof unmistakably require it. Abandonment of a site acquired by eminent domain may result in reversion under the general rule that no fee but only the right to use and occupy the property is acquired by eminent domain (14). Property dedicated for school use will revert when the purposes of the dedication fail (14).

Edwards (8) stated that school district officers may not actually or in effect donate school property for a noneducational use, no matter how laudable the use may be. Thus the renting of a building for one dollar per year for hospital use was held to be illegal in an Arizona case (8).

The effect of a boundary change on the title to school property is often governed by statute, and the provisions vary from state to state (14). In the absence of statute, the common law rule, as generally held, is that the property becomes or remains that of the district in which it is located after the change in boundary (10, 14). However, Oakes (14) reported some authority in support of a contrary view to the effect that annexation gives the new district control of but not title to the school property.

Contracts

Three sources (7, 10, 14) emphasized that boards of education have no inherent power to contract, and pointed out that contracts entered into by a board of education must not only come within a statutory grant of power to make such contracts but must also conform to the manner and form prescribed by statute. The requirements of general contract law must also be observed (10, 15).

Irregular contracts may be ratified by a board of education by acting in a manner that indicates that ratification is intended, and such contract is binding (10). However, the use of improvements which cannot be removed, such as the remodeling of a building, does not constitute ratification (10).

Hamilton and Mort (10) analyzed the cases in regard to recovery under void contracts, and pointed out that the measure of recovery depends upon the type of contract. In the case of express contracts, the recovery is determined by the provisions of the contract itself. If the contract is implied in fact, the reasonable value of the goods furnished or services rendered determines the amount of recovery. If the contract is implied in law (quasi-contract), recovery is based on the amount of benefit conferred irrespective of market price or reasonable value. As a general rule, there can be no recovery from the board of education upon *quantum meruit* on a contract which is *ultra vires* (10, 14), and courts sometimes refuse to allow the board of education to recover payments already made on such contracts (10). Goods furnished under an *ultra vires* contract may be recovered if they can be removed without substantial injury to school district property

(10). Oakes (14) stated that public schoolhouses are generally not subject to mechanic's lien.

Rosenberg (20) pointed out some of the legal difficulties that a board of education may fall into during these times when boards of education may be compelled to purchase without a definite price, and urged that contracts for such purchase state with the utmost clarity and definiteness how the price is finally to be determined.

Insurance of School Buildings

Johnston (12) made a comprehensive and able study of the *Legal Aspects of Insuring Public School Property*, and in so doing analyzed the statutes and supreme court decisions of all of the states, the decisions of the U. S. Supreme Court, and the usual legal digests and encyclopedias. He found that twenty-one states have statutes requiring local school trustees to insure public-school property, and that eight states permit trustees to provide such insurance. In the remaining states, it was reported that the weight of authority seems to hold that school trustees have an implied power to insure school property. This latter is also the opinion expressed by Oakes (14).

It was found in Johnston's study (12) that two states specify by statute that property must be insured for its "insurable value," and in the remaining states the amount of insurance is left to the discretion of the local board of education. The school district, the building contractor, and material-men were all found to have an insurable interest in a building under construction, and the building contract may include provisions for such insurance.

Johnston (12) located no case in which the courts have specifically ruled on the personal liability of a schoolboard member in case of loss of uninsured property, but it was his conclusion, on the basis of extensive collateral evidence, that such personal liability would be sustained only in those jurisdictions where the statutes make it mandatory that school property be insured.

The courts were reported to have held that a district may insure in a mutual company if there is a limit on the contingent liability of the district, and that contracts lacking such a limitation are invalid (10, 12). Numerous constitutional objections to a state insurance fund covering all state property were reported (12) to have been rejected by the few courts before which such cases have been brought. The courts were found to have been consistent in holding that the proceeds of insurance constitute a special fund, which is exempt from attachment for debt, and which may be used only for repairing or rebuilding the damaged property. Johnston (12) found that insurance is not voided by reason of a vacancy clause when a building is not occupied during a usual vacation, but Oakes (14) stated that an extended vacation would void the insurance under such a clause.

Tort Liability

The subject of tort liability is closely related to school plant because most accidents resulting in suits for damages arise out of the use or misuse of school buildings, grounds, or equipment. Figures reported by Fuller (9) indicated that 8117 out of 9482 accidents in Los Angeles in one year occurred on school grounds or in school buildings.

Poe (17) published statistics showing that suits growing out of injuries to pupils are increasingly frequent. He stated that there had been 168 reported cases up to July 1, 1939, and that 138 of these had been reported after 1917. Rosenfield (25) stated that recent cases indicate that the focal points of trouble are faulty grounds and premises and insufficiency of supervision.

Tort liability in connection with the operation of schools is no different from tort liability in general, except for rather far-reaching exemptions. Where there is no immunity from suit, the alleged tort-feasor is not held liable unless he has deliberately or thru neglect inflicted injury upon another. The common defenses which may be used were summarized by Poe (17) and Rosenfield (25).

An important aspect of the subject of torts which is emphasized in both the educational and legal literature is that of the immunity of school authorities and employees from suit. The common law rule is that the board of education is not responsible for the torts of its employees (9, 14) and that the employee is responsible for his own torts. There are, however, exceptions. In Iowa, the employee is exempt from liability for his own negligence as long as he is acting within the scope of his employment (2, 16, 17). Rosenfield (23) reported that New York and New Jersey boards of education are authorized and required to reimburse an employee who is negligent and held liable, but later cases led him to conclude (22) that the New York law was meant to allow suit directly against the board of education rather than to give the employee the right of recovery from the board.

Statutes protecting teachers from suit in connection with school patrol activities in Minnesota, New Jersey, Pennsylvania, and Wisconsin were reported by Rosenfield (25). Poe (17) reported that California school districts are responsible for negligence of employees, while Fuller (9) placed California, New Jersey, New York, Washington, and, to a lesser extent, Connecticut, Minnesota, North Carolina, and Wisconsin in the same category.

Board of education members as individuals are generally not liable for tort either for their own acts in their corporate capacity or for the acts of their employees, altho they may be liable for failure to perform a ministerial duty or when guilty of fraud or false representation (14). Poe (17) reported that board of education members in California are individually liable for their own negligence.

The school district itself is generally held to be immune from suit for a variety of reasons which were summarized by Oakes (14), Hamilton and Mort (10), and others. Some exceptions to this rule have already been noted. New York districts are also responsible for accidents arising from defective equipment; Washington school districts are responsible for injuries to pupils except those growing out of the use of athletic equipment, playgrounds, field houses, manual training equipment, and parks; and California districts are responsible for any injuries resulting from a dangerous or defective condition of the school building, grounds, or equipment (17). Hamilton and Mort (10) reported that in some cases the district has been held responsible for the maintenance of a nuisance, the commission of trespass, and the infringement of patent.

The rule of immunity of school districts from liability has been harshly criticized by many writers. Repko (18) reported over two hundred articles in the law reviews alone since 1924. Fuller (9) reported actual cost figures for California and New York districts which, in his opinion, do not justify the widespread fear that admission of tort liability would lead to serious abuses. He also argued that liability would lead to greater care to avoid accidents, more prompt attention to injuries, and more frequent reprimand or dismissal of careless employees. Warp (26) presented similar evidence that liability does not lead to excessive cost or administrative abuse, and urged that the burden of accidents be borne by the entire community rather than the innocent individual who is the victim.

Chambers (3) found evidence of a "gradual softening of the harsh rule of immunity" but Rosenfield (24) judged the trend to be very slight. Hamilton and Mort (10), reporting on Wisconsin, observed a tendency for the legislature to extend liability and an equally noticeable tendency for the courts to restrict such legislation to very narrow limits. The almost unanimous opinion, according to Repko (18), is that a change must come thru legislation and not from the courts.

Poe (17) recommended an insurance system similar to workmen's compensation as a substitute for the present rule of immunity. Borchard (1) expressed the opinion that the country was not ready to accept such a theory of social insurance, and urged rather that the local community be required to assume more responsibility. Fuller (9) suggested, as a compromise between the present immunity and full liability, that legislation be enacted to permit recovery only for actual monetary damages resulting from tort, and to deny recovery for pain or suffering. He expressed the opinion that such a law would simplify litigation, avoid jury trials, promote prompt recovery, and limit the cost of administration.

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FOREWORD

THE WAR has greatly stimulated interest in counseling and guidance. This interest has found expression in the armed forces and in industry. In both fields the methods and technics developed before the war have been applied and evaluated. In both fields new methods and technics are being developed. More than ever before the need for and the value of skilled guidance and counseling is recognized.

This issue of the REVIEW suggests that after the war one of the major developments in education will be the improvement and expansion of counseling and guidance service from elementary school to university. A much greater number of persons will be employed. Their educational preparation for the work will be broader and more rigorous. A more adequate philosophical foundation will be sought. Evaluative studies will contribute to developing more scientific methods and procedures. There will come a closer unity of purpose and action between teaching and clinical staffs. Methods and procedures will be evolved for effecting more adequate cooperation of school, home, community agencies, and industry in promoting the best possible development of the individual. These future outcomes are foreshadowed in the researches reviewed in the following pages.

Research workers will examine this issue of the REVIEW for the leads it gives to an area of education that will call for much and varied research in the decade after the war. Counselors and directors of guidance will find in this volume help for meeting the growing demands on them for more and better service to children and youth.

J. CAYCE MORRISON
Chairman of the Editorial Board

INTRODUCTION

WARTIME changes are reflected in this issue of the REVIEW both in the increased number of new names that appear among contributors and in the new topics that are introduced. The general structure of previous volumes on pupil personnel, guidance, and counseling has been maintained. The various chapters include some consideration of researches in the fields of personnel work in industry, government, and the armed services, as well as in education. The intent was to deal only with those researches in the above fields which have implications for education. It is, doubtless, too early for an accurate, long-range perspective on the future effects of the increased cooperative activity of schools, government, and industry in dealing with manpower problems of the war. But it would appear inevitable that schools must be keenly attuned to developments in these other areas in order to contribute their share to the readjustments and rebuilding ahead. The title for this volume was modified by the committee to suit the change in scope of treatment, and the new chapter on "Appraisal of Individuals" reflects the increased emphasis on this phase of personnel work in recent years.

The effort has been made to limit the bibliographies to reports of research. The nature of the topics dealt with in Chapter II on "Conditions Affecting Personnel Work" has led to the inclusion of more descriptive references at this point than elsewhere. The innovations in treatment, introduced in the previous issues on personnel work, have been continued in this volume with differential treatment of various references to provide orientation and interpretation with respect to certain trends. For example, Chapter V on "Counseling" includes a somewhat detailed analysis and comparison of different technics as background for the interpretation of trends of research. Chapter VII on "Educational and Vocational Information" provides an overview and a guide for the counselor as to the many researches in occupations carried on by U. S. Government agencies.

Thruout this issue there are many evidences of a growing synthesis of various approaches to the study and understanding of individuals in their life situations and of the dynamic interrelations of personnel and other services within the educational pattern. As more of the current war-time research becomes available and peacetime research becomes possible we may well experience many significant developments in the interrelations of personnel work in the school with similar activities in business, industry, and government.

MARGARET E. BENNETT, *Chairman*
Committee on Counseling, Guidance, and Personnel Work

CHAPTER I

Characteristics and Needs of Individuals

MAY V. SEAGOE and ELIZABETH K. COOPER¹

THE MATERIAL sampled in this chapter has been limited, first, to research studies, and second, to such of these studies as seem to have implications for educational procedures. The general scope of the chapter parallels the three most commonly designated educational levels of elementary, secondary, and higher education but includes three additional classifications warranted by recent research, namely preschool, general adult, and armed services.

Preschool

Increased interest in nursery schools has been reflected in current research. Goodenough and Maurer (19) in their longitudinal study of 495 children pointed out that individual mental growth does not always proceed at a uniform rate. Irregularity is especially apparent at the early ages. Coffey (11) and McHugh (30) both investigated changes in intelligence in preschool children. Coffey found that children whose ratings were below the group mean tended to show greater gains than others after a year of nursery school experience. McHugh explained the rapid advances on the preschool level as due more to gains in adjustment than to growth in mental capacity. Ames (2) studied the locomotor activities in spontaneous play of preschool children ranging in age from eighteen months to four years. She found that at each increasing maturity level the child covers less ground and remains longer in one spot. Wright (54), investigating effects of frustration, concluded that frustration increased the cohesiveness of pairs of friends, but resulted in a tendency to more destructive behavior. Similarly, Barker, Dembo, and Lewin (5) found that constructiveness of play is reduced by frustration and that emotional behavior can be considered a cause of regression.

Further research is needed to verify the predictive value of data obtained at this early level. More longitudinal studies will undoubtedly throw light on adolescent problems.

Elementary School

Research in the elementary field is marked by a multiplicity of studies of the relationships among various mental, social, emotional, and environmental factors that influence the development of a child. Most of the studies have been thoro and extensive, sometimes involving thousands of pupils over wide geographic areas.

¹ The authors are greatly indebted to the following members of the graduate seminar in educational psychology who surveyed the pertinent literature as a joint enterprise. Lillian Cates, Anna East, Rena Forsyth, Edith Hyde, Norah Jones, Milton Katzky, and Helen Livingston.

Physical Development

There was little research during the current period on the purely physical characteristics of elementary-school children. Most of the studies concerned physical growth as related to mental, social, or emotional development. A significant exception was House's (22) study of the body maturation of more than three hundred first-grade children, done by means of radiographs assessed by Todd's Differential Skeletal Maturation method. Only 61 percent of the children were found to have body maturation approximately equal to chronological age, for some being as much as twenty-four months less. In the Third Harvard Growth Study, Dearborn and Rothney (15) continued the annual physical and mental measurement of 3500 children. Their data indicated that there is little relationship between physical and mental growth. For instance, performance on mental tests does not seem to be related to prepubescent growth spurts; nor can rapid growth at adolescence be offered as excuse for a slump in school performance. The study also casts doubts on the practical value of age-weight-height tables, wide differences in development of various segments of the body being found at any age within the same person. Conway and Nemzek (12) investigated the relationship of school marks to amount of illness; and Lee and Nemzek (25), the relationship of school marks to physical defects. Neither study showed any significant decrease in school achievement resulting from factors investigated.

Mental Development

A second focal point for studies of elementary children emphasized mental characteristics, one trend involving the IQ—its constancy, significance, and predictive value. Regarding IQ changes, Miller (33) found comparatively large variation between results of Stanford-Binet tests given first in kindergarten and again in the sixth grade. A recognition of the variability of the IQ implies the necessity of retesting pupils every few years if the IQ is to be used as a significant measure. Feinberg (16) examined 1715 children to ascertain whether EQ could be used interchangeably with IQ and concluded that such a practice was unsound. Thorndike, Woodyard, and Weingart (48) correlated the intelligence test results of 11,000 sixth-grade children with age at time of test and concluded that where promotions are made on a basis of achievement, the rate of school progress is valuable as indication of intelligence. Benson (7) made a follow-up study of 1680 pupils and found that in general pupils with lower IQ's tend to leave school earlier than do those with higher IQ's. Concerning the predictive value of the IQ Allen (1) studied the value of the Kuhlmann-Anderson Test results in the first grade for predicting achievement in Grades III and IV. She concluded from the low coefficients obtained (.30 to .56) that any long-range predicting on the basis of a single group intelligence test in Grade I is questionable.

Today the school is recognized as only one of a number of factors contributing to the mental development of the child. This tendency may explain the large number of studies made to investigate the relationship of intelligence to social and environmental factors. McGehee and Lewis (29) for instance, in their investigation of 20,342 elementary children in thirty-six states found that, with significant exceptions, the high IQ groups come from the high socio-economic homes. Stroud (44) reported similar findings and also the conclusion that socio-economic status has about the same degree of relationship to academic achievement as to test intelligence. Thorndike and Woodyard (47), after investigating 11,000 children in thirty communities, stated that "the average IQ of a community is the greatest single factor in its welfare." A similar conclusion was reached by Wheeler (52) in his 1940 testing of the intelligence of 3250 mountain children in forty schools in east Tennessee. Comparing the results with those of a similar survey made ten years previous, he found that the average IQ in 1940 was ten points higher than that of 1930 and that the 1940 group was superior to the 1930 group at all ages in all grades. The author noted that during the past decade there had been a definite improvement in the economic, social, and educational status of the area. The above studies all yielded positive correlations between social-economic-environmental conditions and intellectual growth, findings substantiated by other current research.

Personality and Adjustment

In studies that attempt to correlate IQ with personality, such as the one by McGehee and Lewis (28), the findings indicate that superior children are likely to possess desirable personality traits. The tendency to rely on subjective evaluation of personality suggests that more objective research may be needed to ascertain the extent of correlation between intelligence and personality, the nature of the relationship, and the effect of one upon the other.

Personality as a factor in school adjustment was the focus of a number of studies. Two studies involved groups of children judged maladjusted or markedly adjusted by teachers' ratings. Dale (13) reported on 171 children given a battery of fourteen personality and achievement tests plus thirty anthropometric measures by trained examiners. No reliable differences were revealed between the well-adjusted and the maladjusted groups in matters of personal inferiority, family relationship, and visual and auditory acuity. Pupils judged maladjusted by teachers tended to be below average in IQ and school achievement. Dale concluded that it was not possible to predict personality adjustment from teachers' ratings. Similar findings were reported by Lovell and Sargent (27), who compared teachers' ratings of 370 elementary boys with scores made on the Rogers Personality Adjustment Scale and the ratings of clinical examiners. The authors observed that physical disabilities, feelings of inferiority, and

family and social maladjustment were causes of school maladjustment most frequently overlooked by teachers.

In a careful study of personality traits, intelligence, and parental occupation of 319 sixth-grade children, Maddy (32) found reliable differences in IQ and personality traits among children of various parental occupational groups. Children of professional families, for instance, were found to average 16.1 IQ points above the children of semiskilled workers and also to score higher in extroversion.

The frequent emphasis on relationships, particularly between socioeconomic factors and the various aspects of child growth and development, seems to be the outstanding trend revealed by the studies reviewed above and by the large body of current research of which these studies are thought to be representative.

Secondary School

Research concerning characteristics of secondary-school pupils includes considerable material dealing with juvenile delinquency and with minority groups. Since these two fields have been covered in a recent issue of the *REVIEW OF EDUCATIONAL RESEARCH*, the present chapter will emphasize other topics related to high-school pupils.

Physical Characteristics and Health

In spite of increased emphasis on physical fitness during the war, there appears to be very little research available at present regarding physical characteristics of secondary pupils. One exception is a study by Dalton (14), who made a visual survey of 5000 pupils and found little if any relationship between normal and defective vision and scholastic achievement. Neher (36) studied 2415 junior high-school pupils and discovered that those of higher intelligence and relatively higher socio-economic levels scored above others on four factors of health knowledge.

Mental Ability and Achievement

Research concerning mental characteristics at the secondary level indicates that mental factors are seldom studied alone. For instance, few studies recently have dealt exclusively with the concept of the IQ, most educators treating it as one of several integrated factors responsible for success or failure. The trends seem to be, first, evaluation of personality development of pupils of high and low intelligence, and second, analysis of certain factors relating to school achievement. Both are treated with a view to establishing sounder prognostic technics.

Typical of the first trend is the study by Buckham and Thelen (10), who compared the interests of a group of physical science students of low ability with those of a group of physics students of high ability. The first group revealed a practical, nonverbal, nonabstract pattern with the

opposite tendencies being observable among the pupils in the second group. Ames (3) analyzed factors related to high-school achievement and concluded that traits of persistence, common sense, and dependability correlate with achievement about as highly as does intelligence. The Ber- man and Klein study (8) of maladjusted pupils of superior mentality supplemented the findings of Ames. Nemzek (37), seeking to discover the relationship between academic success in high school and such factors as age at entrance to school, amount of education of parents, and occupational status of father, concluded that these factors have negligible predictive value.

Personality and Adjustment

A scientific approach to the problem of the relationship of social-emotional characteristics to adjustment in high school was reported by Barker (4) in a study of adolescents over a seven-year period. She revealed statistical evidence of significant differences between those well adjusted and those poorly adjusted to school. Data were presented relative to ability, achievement, anthropometry, physiological maturity, and personality from records collected in connection with the University of California Adolescent Study.

Environmental Influences

Studies concerned with environmental influences in the lives of high-school people emphasize vocational problems, including choices and achievement. Representative of the first area is the study by Boynton and Woolwine (9), who presented evidence based on a survey of 2448 high-school girls to show that girls of the lower economic strata are more likely to fall into predictable, stereotyped, vocational patterns than girls of higher economic levels. In a follow-up study of vocational achievement, Long (26) contributed significant data for vocational guidance. He correlated such factors as intelligence, school achievement, and father's employment status with duration of employment for pupils leaving school during or at the end of the high-school period.

On the secondary as on the elementary level, current research indicates a present emphasis on studies of relationships, revealed by investigations of many and varied factors that affect adjustment and achievement of high-school pupils.

Adolescence

The most comprehensive report on studies in this area was published in the Forty-third Yearbook of the National Society for the Study of Education (35). That volume summarizes significant data and indicates research interests in the whole area.

Higher Education

The impact of the war upon education has probably been greater at the college level than elsewhere, interrupting much research as well as reducing and changing the student population. However, the prewar trend toward the study of the whole student in relation to many aspects of his environment is still evident in available research.

Physical Characteristics and Skills

There are relatively few studies of the physical characteristics of college students, perhaps because of the fact that at the college level physical growth and development are approaching maximum limits. The trend of investigations in this area appears to be directed toward relationships between physical and mental characteristics, and between motor skill and achievement in specific fields. Thompson (46), attempted to discover "the organization of motor and mechanical abilities into specific, group or general factors"; and their relationship to success in different professional schools of a university. He found significant differences in favor of dental and fine arts students as compared to general college students. His results indicated absence of a common factor, and appeared to support the hypotheses of semi-specificity of ability in motor and mechanical skills of the type tested. A study by Johnson (23) of the relationship between physical skill, as measured by an objective test, and intelligence, confirmed earlier findings that no significant relationship appears to exist between these two characteristics. Due to the war, increasing importance has been attached to such factors as the nature and incidence of physical deficiencies, physical strength and endurance, motor skills, and motor learning. One of the results of this emphasis will undoubtedly be an increased amount of research in the near future treating the physical characteristics of college students.

Mental Ability and Achievement

The major emphasis of the research in the field of mental characteristics at the college level appears to be focused upon the problem of the prediction of scholastic achievement. Under this general heading, two principal trends are indicated: investigations of primary mental abilities and scholastic success; and studies of the prediction of academic success in general and in specific fields.

The relationship between primary mental abilities and scholastic success in professional or divisional subject fields is reported by Yum (55), and by Stuit and Hudson (45). Both investigations revealed that measures of intelligence alone are not sufficient to characterize the ability requirements for a professional group or divisional subject field. Smith (42) found high-school grades to be the best single predictive measure of probable success at entrance to college, and high-school grades and intelligence test scores together, a better measure than either alone.

The *University of Minnesota Studies in Predicting Scholastic Achievement* (49) are outstanding in this area. These investigations, carried on over a period of years, include prognosis in the subject fields of science, literature and the arts, agriculture, forestry, and home economics; also in the professional fields of law, medicine, dentistry, nursing, and business administration. The results of the research appear to justify the conclusion that no single measure is sufficient to predict scholastic achievement in college, and that such measures as are used must be specifically related to the particular abilities required for success in any given professional field.

Increasing interest in prognosis at the graduate level is indicated in the literature. Weber, Brink, and Gilliland (51) reported that undergraduate marks correlated positively .62 with graduate marks and predicted success as well as any combination of undergraduate marks and intelligence scores.

A study of the characteristics of prospective teachers is reported by Seagoe (40) in which twenty-one tests were administered in five areas to prospective elementary teachers. These individuals were revealed to be highly selected in certain intellectual, cultural, and social characteristics, somewhat selected in others, and relatively unselected in but few of the factors investigated.

Personality and Adjustment

Recent research in the field of social-emotional characteristics at the college level has dealt principally with two aspects of this field, personality adjustment and the relationship of certain personality traits to success in various activities. Representative of studies of the first type is that of Washburne (50), who investigated factors related to social adjustment of college girls and concluded that those who are most likely to be well adjusted are upperclassmen who come from unbroken homes, who work to earn part of their way thru college, who are engaged in college activities, and who are in the upper 25 percent of college students in intelligence.

Prominent among general studies of personality traits as affecting achievement is that of Richardson and Hanawalt (38), who related leadership to the Bernreuter Personality Measures and found that both men and women leaders in college excel in dominance and extroversion. Sperling's investigation (43) involving 435 varsity athletes, intramural athletes, and nonathletes indicated that experience in physical education activities is accompanied by desirable personality development. Goodman (20) compared the interests and personality traits of 413 engineering and liberal arts students and reported that the engineers are significantly more stable and apparently more self-sufficient than the liberal arts group but do not differ reliably from them in dominance.

Adults in Business and in Industry

While case histories and personal interviews are still held to be essential to personnel work on the adult level, there is a trend toward measuring

aptitudes and personality traits by objective testing. Bennett and Cruickshank (6), for instance, discovered that mechanical problems that were difficult for women were easy for men, and those that were easy for women were also easy for men. For jobs requiring particular kinds of dexterity and coordination, the need for special tests is recognized. Research in job and worker analysis and in the development of instruments for worker appraisal is reported in Chapter IV.

Concerning psychological factors in industry, Wren (53) studied 2000 cases and concluded that individual liking for the work and staying on the job are closely related. Richardson and Hanawalt (38) reported on the personality traits of adult leaders, with the conclusion that leaders tend to be more stable, extroverted, self-confident, self-sufficient, and dominant than nonleaders.

In a follow-up study of vocational adjustment Moore (34) concluded from his study of 10,064 youths that without guidance individuals tend to find the jobs for which they are best suited. A different conclusion was suggested by Foster and Wilson (17) in their study of one hundred women college graduates, which indicated that education had failed to prepare these women for many of the exigencies of life.

Since characteristics of adults are not directly related to school objectives, there seems to be less published research on the adult level that has direct bearing on educational problems. Much of the research reviewed stressed technics of guidance rather than results. However, education should profit by more information regarding the nature of the individual as he takes his place in the adult world.

Armed Services

Much of the published research dealing with the armed services emphasizes methods of appraisal rather than obtained results. This is to be expected of studies done at the height of the induction period or in the early months of the war when the major problem was selection of personnel. These studies are reported in Chapter IV.

Significant findings relative to adjustment in the armed services are already being reported. Smith (41) studied the neuroses resulting from combat at Guadalcanal and estimated that 30 percent of the war casualties will consist of constitutional psychopaths. Smith's estimate was substantiated by the work of McKerracher (31) who studied the psychiatric problems in the Canadian army overseas. Adjustment from a different point of view concerned Haskell and Strauss (21) who reported on the military records of one hundred parolees from an institution for mental defectives. Of the one hundred men, seventy-four had remained successfully in the army with one-third of them receiving promotions.

A third area of research concerns problems of discharge. Ginzberg (18), for example, studied the occupational adjustment of a group of selectees returned to civilian life in 1942, and found that both skilled and un-

skilled workers showed a preference for returning to the type of job held before the war. Semiskilled workers, however, were looking for new openings and were willing to sacrifice immediate income for improved skills. All groups showed marked tendency to find employment in fields closely related to army duties.

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CHAPTER II

Conditions Affecting Personnel Work

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THIS chapter reviews the researches on conditions affecting personnel work in educational institutions and similar studies in industry, government, and the armed services that have implications for education. The impact of the war is noted in many of the publications that have appeared during this period. In the sections that follow, attention is given to problems of school attendance, promotions, personnel records and reports, and evaluation as these relate to the establishment of conditions that make guidance effective.

School Attendance

The effect of the war on school enrolment and attendance has been a major concern in both research studies and in articles dealing with practices and procedures during the period covered in this volume. Back-to-school campaigns were conducted to encourage youths to continue their education, and school-work programs were inaugurated as one means of keeping more boys and girls in the secondary schools. Chiefly as a result of the war there appeared several new tendencies affecting attendance other than those noted in previous reviews of research (53) in this area: (a) reversal of the downward trend in the birth rate; (b) decrease in secondary-school and college and university enrolments; (c) greater population mobility resulting from the migration of people to war industry centers.

Enrolment

The downward trend in school enrolment continued. According to the estimate of the Bureau of the Census (11), the school population, ages five to seventeen, was 29,200,000 on July 1, 1942, as compared to the peak number of 32,400,000 on July 1, 1934. Because of the low birth rates in the 1930's Blose (11) predicted a further decrease of approximately 600,000 in elementary-school ages between 1942 and 1946.

In considering future school enrolment, Reeves (116) pointed out that "the trend of school population in any given city is difficult to predict because of the general migration of people from cities having no war industries and from rural regions to the cities having war industries." In some areas the birth rates would increase whereas in others there might be a rapid decline. Hence the effects of population migration should be considered separately from the birth-rate trend in estimating future school population for any particular city.

Because of the war and greater employment opportunities for youth, the first decrease in enrolment appeared in the year 1941-42 when 326,000 fewer pupils (11) were enrolled in the public secondary schools. A survey made by the National Association of Secondary-School Principals (55) showed that secondary-school enrolment decreased almost 6 percent between October 1, 1942 and October 1, 1943. Total pupil enrolment in the secondary schools was estimated as 5,758,000 as compared to the peak enrolment of 6,714,000 in 1940-41. A further decrease of about 1,500,000 in the number of boys and girls of high-school age was expected between 1942 and 1952, after which the present increases in birth rates would effect increases in the secondary-school age group (11).

Because of increased opportunities for employment and the entrance of so many young people into the armed services, enrolments in higher institutions were seriously affected. During the school year 1942-43 there were four students for every five that had been enrolled in colleges and universities in 1939-40. Three men students were enrolled for every four men students three years ago, and seven women students for every eight women students (34).

Factors Influencing School Attendance

The data collected by the National Association of Secondary-School Principals in a survey of the effect of the war on secondary-school enrolments indicated the following as major causes for decrease in pupil attendance (55): (a) previous decreases in birth rates; (b) numerous employment opportunities and high wages available to youth; (c) entrance of youth into armed services; (d) instruction of low quality due to poorly qualified teachers employed on emergency certificates; (e) employment of both parents with resulting increase in truancy and absenteeism.

Taylor (136) studied the records of the illnesses of 7000 white pupils in the Louisville public schools in relation to attendance records. He assembled data showing the causes of absence and their effects on attendance during the various seasons of the year and at the various age and grade levels. He found that ten illnesses caused approximately 86 percent of all school absence due to sickness and that sickness was responsible for about 80 percent of all absence.

When the absences of groups of white and Negro pupils in the Louisville schools were compared, Taylor (135) noted that sickness caused 80 percent of the total white absence and 59 percent of the total Negro absence. The white group averaged three absences for each absence in the Negro group. However, Negro pupils lost nearly twice as much time per individual absence as the white pupils. Taylor suggested that the length of absence among Negro pupils might be due to lack of proper medical care at home, low resistance, or poor environmental conditions.

In an intensive study of fifty-five difficult attendance cases in a Pittsburgh junior high school, Nebs (104) found a complex picture of causative

factors operating in each case. Almost three-fourths of the boys and girls studied came from substandard home backgrounds. A majority of the youths had experienced unsatisfactory school careers as well as unhappy home situations. There were thirty-eight cases of school retardation ranging from one to four years. Nebs concluded that the school problems must have started in the early grades and might have been prevented by suitable treatment at that time.

Means of Improving Attendance

Nebs (104) concluded that the most constructive work could be accomplished when maladjustments were detected in their early stages and recommended that school records be watched to detect incipient difficulties and make early referrals to the attendance department. As a means of improving attendance, Taylor (136) suggested that school and community health authorities use the data on seasonal trends of sickness, the actual causes of sickness, and its age and grade location when formulating their health programs.

A study of 2329 cases of absenteeism in a junior high school over a two-year period by Van Loan and Williams (145) yielded the following recommendations: (a) more careful analysis of the pupil's absence report, with home visits made by the school nurse to ascertain causes of absence; (b) presentation of the absence reports to pupils by the social-living teachers to develop pupil understanding and cooperation with respect to the loss of district funds due to low average daily attendance; (c) class discussion of diet, recreation, clothing, ventilation, and common symptoms of illness with science, health, and physical education teachers to develop a personal awareness on the part of the pupil of his own problems.

Increasing the Holding Power of Secondary Schools

Jessen (62) described some of the practices and experiences of various school systems in securing return of pupils to school during the fall of 1943. Among the methods used to stimulate return to school were the following: plan of operation under which students attended school part time and were employed part time; adequate guidance and counseling service; utmost flexibility in school program adjustments; letters to students and parents; personal interviews with students and parents; follow-up to help adjust difficulties; newspaper and magazine publicity; special perfect attendance awards; parent-teacher meetings. As a result of the back-to-school campaign the drop in enrolment was smaller than had been anticipated.

Administrative Organization

Wilson (153) made an intensive study of 133 attendance cases in a junior high school in order to evaluate methods and procedures. He recommended

that homeroom teachers be given fuller responsibility in matters of attendance; that records of all types should be more complete and extensive; and that greater emphasis should be placed on the desirability of decreasing the number of one-day absences.

Handbooks on school attendance service were issued in Connecticut and Florida. The Connecticut handbook (23) dealt with the fundamentals of an effective service, attendance organization and practices, including technics to be used by attendance workers in locating causes of maladjustment and in working out remedies. The Florida handbook (39) included a discussion of factors related to attendance, together with a listing of a variety of problems for consideration.

Promotions

Acceleration

During the triennium several studies were made to discover the ways in which institutions were providing for acceleration (26, 27, 33, 128). Some common patterns revealed by a questionnaire study of 947 colleges included a longer school year, admission of students without a high-school diploma, heavier academic loads for students, modification of the curriculum, use of honor courses, and the granting of credit thru proficiency examinations (33).

Douglass (28), Melchior (92), and Spears (129) summarized the arguments for and against acceleration. Allen (3) warned especially against such hazards as fatigue, neglect of the broad purposes and interests of school life, accentuation of negative attitudes toward work, undesirable regimentation, and intolerance of human differences. Other writers pointed out that colleges which accepted students without high-school graduation should assume certain responsibilities: collection of comprehensive information about students including evidence of social and emotional as well as of intellectual maturity; adaptation of instruction to the needs of younger students; provision for adequate guidance and counseling and for carefully supervised housing and recreation (96, 155).

Several evaluative studies of accelerated programs were reported (57, 85, 112, 114, 146, 151). Students expressed strong approval of acceleration (85, 151). Two investigations indicated that many students were able to complete college at an earlier than conventional age without injury to health or lack of participation in extracurriculum activities (112, 114). An analysis of biographical accounts of an earlier and of a more recent group of outstanding persons revealed a postponement of accomplishment with extension of the period of education (115).

Provision for Pupil Progress

Many schools continue to require pupils to meet minimum grade standards for promotion. Elsbree (35) showed that this traditional practice was not supported by research studies. In an effort to remove some of the diffi-

culties of this practice, two large school systems changed from semiannual to annual promotions (77, 141), and two others removed the grade barriers in the primary division (15, 113). In some schools a two-year promotion period proved advantageous from the standpoint of learning, pupil growth, and pupil-teacher relationships (141).

Collins (21) and Theman (137) reviewed current practices with respect to continuous promotion. The five-year records of one such program showed that, of the students who would not have progressed under the grade-standards plan, 40 percent had attained normal progress within one year, 15 percent within two years, and 8 percent within three years (101).

Studies Dealing with Nonpromotion

During a one-year period 10 percent of all the subjects studied in the academic high schools of New York City were failed (74). During a three-year period an average of 6.6 percent of failures was reported for the elementary schools of Columbus, Ohio (9). In another school system the amount of failure in the elementary and junior high schools was reduced to 1 percent (118). In North Carolina approximately one-fourth of the public-school pupils failed or withdrew from school during the school year of 1939-40 (106). The North Carolina survey (106) showed the two points of greatest difficulty to be the first and eighth grades. In Columbus, Ohio, the subjects failed in the elementary schools were, in the order of frequency, spelling, arithmetic, reading, geography, English, history, writing, music, and drawing (9).

A school psychologist investigated the causes of failure as reported by teachers and found many reasons to be poor justification for nonpromotion (41). Mateer (91) found administrative policy to be an important factor underlying failures. Two other investigators found that the boys' chances of failure were about twice as great as those of girls' and concluded that the curriculum and teaching methods failed to utilize fully the boys' interests and abilities (10, 119). Three investigators reported failure or fear of failure to be an important cause of students' withdrawing from school (47, 125). One group of withdrawals expressed major dissatisfactions with vocational, educational, and personal counseling (47).

Programs for Slow Learners

In the June 1944 issue of the *REVIEW OF EDUCATIONAL RESEARCH*, Hockett (56) reviewed the research on current problems and practices in the education of the mentally handicapped. References covered by him are not included in this section.

The plan for slow learners reported most frequently was segregation (49, 68, 102, 113, 120, 148, 149). The findings of the Speyer School experiment did not support the practice of segregation (46). In the final report the recommendation was made that slow learners should follow a modified program in regular classes. Other investigations also indicated that the

needs of backward children were best met by adjusting curriculum content and teaching methods to the level of individual pupils, by recognizing pupil effort, by giving slow learners an opportunity to participate in school activities, and by promoting pupils on variable standards (61, 63). In St. Louis the use of such methods produced a marked change in the grade classification of pupils (63).

Concrete experience and constructive activities were utilized in curriculums for slow learners. In the Speyer School experiment trips and visual aids were used extensively, and reading materials were used far less extensively than is ordinarily the case (46). Dramatic activity was made the core of one curriculum (98), and games and specialized activities were incorporated in another (69). At the University of Iowa it was recommended that freshmen of low scholastic aptitude be encouraged to interest themselves in the graphic and plastic arts, and that they be freed from certain subject requirements (67). Statistical data on the experimental group did not support the plan, but it was considered probable that more meaningful results might be obtained thru the case study method.

Provision for Superior Students

The current patterns of special education for superior students are acceleration, segregation, and enrichment. Gray (45) noted a trend toward the modified enriched program. Drag (30) reported that enrichment was the plan followed by fifteen of the twenty California school systems studied by him. Four Detroit schools initiated programs of enrichment thru specialized activities (7). A high-school teacher of algebra provided enrichment by means of "honor units" (138). In some other high schools enrichment was provided thru honor classes (16, 25, 99). In the report of the Speyer School experiment segregation was opposed for slow learners but was recommended for superior students (46). A nationwide questionnaire inquiry disclosed that segregation thru the use of special classes was the plan followed by a large minority of the high schools (103).

Four evaluative studies of accelerated programs for superior students were reported (16, 19, 20, 65). These programs proved effective for facilitating the development of good work and study habits and the mastery of subjectmatter. They were found to be even more valuable, however, because of their positive, wholesome contributions to personal and social growth.

Correlates of Success and Failure in Schoolwork

The conditions and correlates of academic success and failure were investigated. A comparison of 1078 educationally accelerated pupils with 756 educationally retarded superior pupils revealed that of the two groups the accelerated pupils possessed more desirable personality traits, more intellectual interests, and superior home backgrounds (80). Another study showed that the students who had the greatest amount of scholastic underachievement were also the most maladjusted emotionally (37). Musselman

(100), however, found a negative relationship between personality adjustment and scholastic achievement. He reported that, of the personality traits studied, only truthfulness was associated positively with achievement.

Some studies were made of the relationship between specific factors and college achievement. Students with definite vocational choices were found to be mediocre and high in scholastic performance, whereas students undecided as to vocational selection were consistently low in performance (87). At one university the place of residence seemed to have a negligible effect upon scholastic achievement (143), but at another it was shown to have a significant positive effect (111).

Several investigations indicated that the intelligence rating of the student was neither the only nor the main factor which made for survival and success in school. The number of low ability students graduating from college made Stalnaker (130) and Marshall (87) consider it unwise, if not futile, for counselors to try to establish critical scores. Cohler (20) found that academic achievement was the resultant of factors other than those measured by intelligence tests and that levels of expectancy based mainly on mental age were of little value for bright children. Douglass (29) concluded that an important fact in guidance is that success in college depends not only upon mental ability but also upon the institution and the curriculum selected. Another investigator reported that persistence, common sense, and dependability showed about as high a correlation with achievement as did intelligence (5). And a study by Bonney (12) of the interrelationships between various aspects of growth disclosed the least relationship between intelligence and academic achievement and between intelligence and social success.

Pupil Records and Reports

Research reported in the February 1942 REVIEW OF EDUCATIONAL RESEARCH (44) suggested several trends in the field of pupil personnel records and reports. Many of the studies reported were the result of inquiries of school systems to other systems as to their records and reports. The tendency was either to adopt or adapt the records thus discovered. A change in the records toward a broader conception of pupil behavior was indicated. Anecdotal records were beginning to be used in addition to the usual data. Cumulative records had assumed a larger place in the total picture of records and reports.

As one reviews the recent research in this field, three impressions stand out above the detail. In the first place, the broadened concept of the items to be entered on records and reports (44) has continued at an accelerated rate. A second fact is that greater attention is being given to the use of records. Increasingly, records are being thought of as instruments for teachers as well as administrators and specialists. Third, one is impressed with the small amount of really significant research, most of the studies to be reported being limited to local preparation, use, and evaluation of records and reports.

Records and Reports for Guidance Purposes within the School

The U. S. Office of Education (142) has attempted to assume leadership in this field by inquiring as to the use of the cumulative record forms and thru having a committee attempt to appraise the validity of items found on cumulative records. State departments of education have also had a part in helping schools with their records and reports (123) and one state department has made a statewide study of the problem (95). Some emphasis has been given to the reports of schools to state departments of education and other agencies (73, 127). The kinds of reports required by agencies outside the school or by central administrators may be related to questions of democracy in school administration (17).

One report of the *Eight Year Study* (126) contributed much to the research in this area. It demonstrated the importance of studying all aspects of behavior in terms of the person in his environment and contributed particularly to pupil appraisal with respect to the newer aspects of thinking, appreciation, adjustment, and social sensitivity which are being given emphasis in forward-looking schools.

A number of studies deal with items which should be included in pupil cumulative records, and to the newer trends in their preparation and use (52, 75, 78, 83, 90, 134). When one school attempted to overhaul its record system it found that important steps in the reorganization of records were needed (42, 122).

Studies and descriptions of practices indicated the growing recognition that pupil cumulative records are an integral part of the guidance program (66) and that their use is not an end in itself but facilitates the process of guidance (72). A guide for counselors in the utilization of pupils' personnel records grew out of considerable research (24). The broader use of cumulative records as instruments in the development of desirable qualities of citizenship and wholesome personality has been emphasized (50). Reports indicate their value in reducing discipline problems at the high-school level, in conferences with pupils and parents, and in helping teachers with their work (14).

Teachers increasingly are participating in the building and use of cumulative records (4, 86). A revised edition of Strang's handbook (133) on teachers' records has been published. Experience has shown that parents can contribute much to the record of a young child (89) and that pupils also can share helpfully in the process of record-making (75, 84). An understanding of the importance of his record has a motivating effect upon the pupil (36, 64). One school uses letters from employers in a similar fashion to challenge pupils to their best effort (36, 81).

Anecdotal records have proved helpful in pupil conferences (64). An attempt has been made to find an improved shorter method of studying behavior that may retain the values of the anecdotal record. This research (144) indicated possibilities for the wider use of pupil descriptions in the

high school. An excellent summary of existing practices in the evaluation of pupil growth in elementary schools has been made (48).

Student records have been shown to have an important place in college personnel programs (71), both for the beginning general student (6) and the more advanced specialized student (97), and also to aid in discovering those students who should be encouraged to enrol for advanced standing (107). In one college the attempt was made to analyze advisers' reports (8). A university dean of women has reported the helpfulness of the case study technic (43).

Records and Reports for Transfer of Pupils from One School to Another

Records and reports are not only of value in guiding the pupils within a given school but they are also important aids to the satisfactory adjustment of a pupil when transferring to another school (32).

The secondary school owes a genuine obligation to the college to furnish significant personnel data about its prospective students (109, 139). An emphasis which has not been noted in previous issues of the REVIEW OF EDUCATIONAL RESEARCH is the important place which the college registrar is being called upon to assume in a complete personnel program. The records in the registrar's office are a source of much guidance information both within the institution and for the purpose of helping students transfer satisfactorily to another school (76). The college registrar's office should contain a complete and accurate record of the precollege work as well as of the college work (124). Too often these records have not been complete (94) or have become illegible due to lack of attention to proper technics (79). Registrars are increasingly in agreement as to the essential elements of a satisfactory transfer record (18).

Records and Reports for Those Who Leave School

There is evidence of increased recognition that the school has a definite responsibility for giving prospective employers understanding of the characteristics of students who seek employment (13, 40). The kind of information now supplied employers emphasizes the personality of the pupil as well as his academic achievement (110).

Heavy demands have been made on personnel workers in the interpretation and use of student cumulative records to facilitate the successful transfer of students from school to war service (117, 154). These personnel services have included the furnishing of transcripts of academic records and other information of value in appraising assets of individuals for service (70, 105, 121), and medical and social histories of former students when needed (54). Educational experience summary cards have proved of value to draftees (38). Interestingly enough, individual record cards have proved of value for civilians in the problems of evacuation in Europe

(147). This new emphasis on the use of records and reports for wartime service will perhaps have significance for all out-of-school and post-school services in the future.

Evaluation of Counseling Outcomes

A most pertinent question in the field of counseling is, "Does the process assist the student in becoming better adjusted, and, if so, in what ways and how much?" This question must be answered if counselors are to know what factors affect guidance and how to make improvements possible. Despite the rather extensive growth of high-school and college guidance programs, research studies in evaluating outcomes of these programs are not numerous.

Evaluative Criteria

During recent years, the importance of evaluating the outcomes of counseling has been stressed and criteria of evaluation suggested. There is rather general agreement that a combination of several criteria is more satisfactory than the use of any single one, such as improvement in scholarship. Williamson and Darley (152) proposed four broad evaluative criteria: (a) a case work method which involves the reading of case histories by competent counselors who make professional judgments of success in adjustment; (b) scholastic adjustment in terms both of students who leave college because of low scholastic aptitude and of those who are successful. (The former group may show desirable outcomes of counseling if they become adjusted to the fact that they have little or no chance of college success and act accordingly); (c) students' satisfaction with counseling; and (d) change and development of attitudes toward vocational or other problems. A related problem, that of determining the adequacy of occupational or other adjustment, has been discussed by Lurie (82) who concluded from the limited data available, that occupational adjustment is a composite variable whose component parts perhaps cannot be scaled on a linear continuum and suggests that the structure and dimensionality of this criterion need further study.

Methods of Evaluation

The experimental designs that have been evaluating counseling outcomes are: (a) comparison of students' grade averages before and after counseling; (b) comparison of the average scholastic, vocational, social, or occupational adjustment of counseled students with that of noncounseled students matched on such characteristics as age, sex, ability, size of high school, and high-school or college grades; (c) a control group experiment in which two comparable groups are given different types of counseling (or one group may receive no organized counseling) and the groups are compared both before and after counseling is given. Other methods used

are: clinical or statistical follow-up studies of counseling cases with judgments of adjustment and insight, and students' judgments of the value of counseling. In neither of these last two methods has a control group been used. Of the three experimental methods, the third is, in most respects, the most satisfactory from the standpoint of experimental design.

Counseling Outcomes

Hutson and Webster (60) compared tenth-grade pupils enrolled in a homeroom guidance program with the previous year's tenth-grade class which had no such program. They found the experimental group made vocational choices more nearly corresponding to their aptitudes, more appropriate decisions about attending college, and better grades in elective courses in French, shorthand, and advanced algebra. This study has certain methodological advantages over those usually made, but the reader remains in ignorance as to whether the groups were experimentally comparable.

Mellon (93) reported students' judgments about a limited guidance program in a small high school. More than 70 percent stated that they found the guidance helpful and less than one-fifth thought the program was not helpful. Freshmen and sophomores wanted more emphasis upon social adjustment problems while upper-class students preferred help on vocational and educational questions. Dugan (31) found no appreciable effect on the vocational choices of ninth-grade students of teachers' knowledge of these pupils' interests, abilities, and ambitions.

Abramson (1) found that those students planning to follow professions were the least likely to change plans after counseling, whereas those aiming for semiprofessional and managerial work tended to reorient their occupational choices to more appropriate levels. Realization of the lack of ability was the primary reason given for abandoning and changing vocational plans.

Compton (22) reported a group guidance project carried out in an elementary psychology class. Personality, study, English, reading, and ability tests were administered to 135 sophomores and the results were given to the group. Individual interpretation of test data was given if students requested it. Results from a questionnaire given at the end of the course showed 54 percent of the students reporting beneficial attitudes and only 6 percent saying that the experience was detrimental. Self-understanding was reportedly improved in 79 percent of the class. No comparable questionnaire was given to a control group so one must refrain from concluding that the project accounts for all or even most of the outcomes. Nevertheless, the technic would appear to have value in a multiple approach to counseling, or as a group method in a smaller school not employing trained counselors.

Paterson and Clark (108) used freshmen students' judgments of counseling to evaluate a faculty counseling program. More than half of the stu-

dents rated the assistance as being of great value or quite helpful and only 10 percent thought the services were of no help. Ninety percent of all groups reported they would urge a sibling to consult a faculty counselor.

Humphrey (58) compared the results for four groups: (a) freshmen advised by faculty counselors, (b) those advised by trained counselors, (c) those advised by both, and (d) freshmen with no counselors. Group "b" was better oriented to university life than Group "a," especially in terms of social adjustment as measured by activity and recreational participation, and in terms of educational and vocational guidance with respect to study habits, proper choice of courses, personality traits affecting occupational success, and grades. Group "c" achieved the most effective orientation of the three counseled groups. The three counseled groups made more vocational reorientation than group "d." Humphrey found that having received high-school counseling did not differentiate the groups. She also stated, as did Stone (131), that information about vocations was not sufficient to be of much help in itself nor was knowledge of vocational interests and aptitudes adequate in the absence of professional interpretation. Altho the four groups were differentiated on the basis of vocational adjustment and social-recreational participation, they were not differentiated with respect to assistance in solving personal problems. Humphrey concluded that the faculty counseling and the clinical counseling programs complemented each other.

Stone (131) reported that a combination of individual counseling and course instruction in vocational orientation produced significant changes in social adjustment as measured by a personality inventory. The experimental group tended to adjust vocational choices to more appropriate levels in terms of abilities, interests, and aptitudes. The vocational information which the control group received in class did not appear to be of much assistance since the control group did not improve significantly in determining appropriate vocational choices after the course was completed, and for some individuals the information seemed to have negative value.

Aldrich (2) concluded from her experiment that individual social counseling and directed participation in extracurriculum activities improved the social adjustment of freshmen girls as measured by personality scales and a questionnaire. Triggs and Bigelow (140) studied the responses of student nurses to counseling and discovered that the girls consulted fellow-students more often than they consulted teachers or counselors. The help received from faculty and counselors, however, was reported to be of greater value than the advice of friends. The students stated that the aid they received from counselors and instructors was not as complete as they desired. Humphrey's (58) four groups also emphasized this insufficiency of counseling assistance.

Webster (150) studied eighty-one of an original group of 125 private clients (age range twelve to forty-two years) two to five years after counseling. The details cannot be reviewed here but the original article is worth reading because of the careful criteria used. When he discarded cases which

could not be categorized unambiguously, he found 80 percent accuracy in vocational prediction and 92 percent accuracy in predicting academic success. When all cases were considered his predictive accuracy was 87 percent. On a six-point rating scale, 82.7 percent rated the value of the counseling above the midpoint of the scale. Clients tended to accept educational recommendations more readily than vocational advice. More than three-fourths of the group believed vocational guidance should be given to all adolescents as they leave school.

Hunt (59) and Stott (132) reviewed the Birmingham, England, studies in evaluation, most of which have been reported in the last decade. The original studies upon which these reviews were based exhibited careful methodology, the chief handicap being an occasional failure to use quantitative terms when expressing individual and group differences.

During the past three years several significant studies of counseling outcomes have been published. However, they have been made from differing orientations and none appear to have been part of a larger, coordinated plan. It is desirable that a more thoro and systematic program of research in this area be pursued if counseling is to gain in effectiveness. Better guidance will become possible in proportion to our knowledge of the conditions and technics which influence the client's adjustment.

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CHAPTER III

Programs of Personnel Work¹

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SYSTEMATIC evaluations of personnel programs continue to be numerically inadequate. Many articles describe guidance programs; some contain very brief evaluative statements. A few of these, altho not strictly research, have research implications and have been included in this chapter. However, the attempt has been made to confine the references in this section primarily to those that may properly be classified as research.

The title "Programs of Personnel Work" obviously needs interpretation. It is evident from an examination of the literature that this combination of words can refer to a single aspect of the personnel program such as a testing program or a program of interviewing, as well as comprehensive all-inclusive personnel services. In order to avoid unnecessary duplication, the research studies alluded to in this section will be confined to those in which the total program is evaluated. Articles covering a single aspect of the personnel program have been included only as they have meaning in appraising the total program.

Elementary-School Programs

Organized programs of guidance in elementary schools have been the exception rather than the rule. Guidance at this level has been centered, and rightly so, upon appraisal of the pupil's strengths and limitations and upon developmental or corrective treatment. Kavin (30) presented evidence to show that early isolation of pupil problems in first and second grades has resulted in fewer reading problems in high school, better achievement records, a more satisfactory assimilation of slow learning children in normal groups, scientific promotion, greater opportunity for the gifted child, and fewer personality problems in high school. This study points to the wisdom of a personnel program which detects deviations from normal conduct and development in the early grades. Flory, Alden, and Simons (19), attempting to improve pupil personality, asked teachers of the fourth, fifth, and sixth grades to establish procedures in their classrooms which would help improve the personal and social adjustments of pupils. The majority of pupils seemed to gain from the experiment. The authors recognized that this study had one fundamental weakness, namely, the failure to show which technics were most helpful. Hamalainen (23) asked teachers to prepare anecdotal records and to make record summaries of 119

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pupils in Grades IV, V, VI, and VII. His analysis indicated that anecdotes depend upon cumulative weighting to gain significance, that the unusual incident often has the greatest guidance implications, and that keeping anecdotal records tends to focus the teacher's attention upon the needs of individual children.

Secondary-School Programs

Greenleaf (22) surveyed 25,000 schools and found 6799 with guidance programs. In the extreme East and the Far West, 40 percent of the schools provide guidance programs. In the North and West, 20 percent have programs in charge of counselors, while in the South, less than 20 percent provide guidance service. Segel and Proffitt (42) described practices and listed research studies of guidance divisions of state departments of education. This survey type of research shows so clearly the progress of the guidance movement that it should be done at least biennially with the results widely publicized.

It has been assumed that a good counseling program results in more realistic occupational choices. One of the best studies in this area was conducted by Hutson and Webster (27), comparing one group of pupils who made their choices without benefit of counseling with another group who had been counseled. The experimental group showed appreciably greater evidence of wise selection of college and of occupation. This technic of group comparison should be used more frequently. Roeber and Garfield (40) discovered that boys showed greater maturity in selecting occupations as they neared graduation while Livesay (31) found occupational choice related to a favorite subject.

Follow-up studies were used to measure the effectiveness of the school personnel program. Davis (14) wanted to discover why able graduates failed to go to college and to what extent slow-learning graduates of high school actually entered college. Lack of finances seemed to be the greatest factor in preventing graduates from entering college, while sufficient financial support was influential in causing slow learners to enter. The study points to the need for more scholarship assistance for able pupils. Benson (9) examined the scholastic records of 1680 pupils who had been tested in Grade VI and found that test records of the elementary school were predictive of subsequent scholastic achievement in high school and college. A follow-up program with important implications is Terman's study (46) of the vocational successes of intellectually gifted children. Three psychologists examined the postgraduation records of six hundred cases and rated each on life success. The subjects were then classified into three groups: the highest fourth, "the A group"; the middle half and the lowest fourth, "the C group." The educational and vocational achievement differences between the A and C groups were outstanding. Terman attributed these differences to the existence of stronger educational traditions in the families of the A group, and to the greater aggressiveness, emotional stabil-

ity, and better social adjustment of the members of the A group compared with the C group. These differences had been apparent during childhood. The study showed that factors other than intelligence affect vocational achievement and that recorded observations of children in their early years have significant bearing upon their later educational and vocational adjustment.

Articulation between Secondary School and College

Three volumes concerned with the Eight-Year Study were published during this period. This longitudinal research program is of great significance because of the character of the study and the demonstration of skill and ingenuity with which new methods of evaluation were devised. Smith and others (43) in the volume *Appraising and Recording Student Progress* described the methods of measuring outcomes. The first chapter of this document presents the underlying assumptions and methods of evaluation. The report contains a description of the development of measuring devices in areas which have defied measurement: ability to think clearly; social sensitivity; appreciation; interest and personal adjustment. Procedures used in recording information for counseling and transfer are described. Subsequent research will undoubtedly be undertaken to compare these technics with older methods of recording pupil behavior.

A follow-up of graduates of the "Thirty Schools" after entrance into college was reported by Chamberlain and others (12) in the volume *Did They Succeed in College?* This follow-up study involved 1475 matched pairs of college students selected on the basis of those who were admitted under conventional entrance requirements and those who were admitted without them. This technic of matching has been subjected to some criticism altho the authors described in detail how carefully the matching was done. The study indicated that preparation for college might safely be left to high-school authorities and that the graduates of the "Thirty Schools" as a group have done as well if not better than the comparison group. Of interest to the research worker are the technics, the forms, the methods, and the criteria of evaluation. The third volume about the Eight-Year Study (39) contained word pictures of each school and what each was able to accomplish during the experimental period. Frequent reference was made to changes in guidance and personnel programs.

One other study of articulation between high school and college deserves mention. Jones (29) described a program in which interested juniors and seniors in high school were brought to the Worcester Polytechnic Institute campus for a ten-day program of interviews, testing, and supervised visitation. The boys who participated in this program rated the following technics listed in order of importance: the interviews, the trips, the lectures, and the tests. The program helped them either to make or to confirm vocational choices. Perhaps this study is indicative of a trend for longer and better supervised periods of precollege visits.

College Programs

Several follow-up studies point to the effectiveness of college personnel programs. McCune (33) concluded on the basis of a study of occupations of junior college graduates that the junior college must go further than it has in making provision for terminal courses on the junior college level. Upshall (47) compared 112 students who scored highest on the American Council of Education Psychological Examination with 112 who scored the lowest. He found graduation from college more influential in determining occupational level than a high or low A.C.E. score. Greene's (21) study of nongraduating women showed there were other causes for dropping out of college than intellectual capacity and suggested that counseling programs include discussion and treatment of problems of health, outside employment, and social needs.

Eckert (16) and Humber (26) evaluated the General College program at the University of Minnesota. Eckert compared the social, personal, and vocational progress of General College students with that of students attending other divisions of the University of Minnesota. Humber's study was concerned chiefly with occupations and salaries of General College graduates. The students mentioned educational and vocational counseling as the most helpful experience of their college days.

Schneidler and Berdie (41) and Douglass (15) concluded that success in college depends in part upon the institutions and curriculums selected, and that various colleges require different levels of ability. Such differences should be known to counselors who assist young people to select appropriate colleges. Berdie (10) asked 150 male high-school graduates to rank eighteen factors as to their importance in choosing a job. Certainty of continuous employment and opportunity for advancement were rated first and second on the list. Desire to make money was third. The trend toward appraisal and treatment of personality and social adjustment problems was revealed by the studies of Aldrich (2) and Congdon (13). Their results seem to justify the use of personality questionnaires and check lists as counseling tools.

Programs in Industry and Government

Research in industry reflected the problems associated with the war and with war plant production. Achilles (1) in a questionnaire study of 147 firms found that 66 percent used tests to predict job success. Bennett and Fear (8) indicated how helpful tests could be in job selection and Irwin (28) described the Lockheed testing program. Allen and Krone (3) stressed the need for testing to supplant "last grade attended" as a criterion for determining minimum educational requirements.

What can be done for the handicapped on a statewide basis was described and evaluated by Marquis, Novis, and Wesley (35). The kinds of cases were listed; the measuring devices were described; and recommendations were made. Research with programs for the handicapped is greatly needed.

New developments in industrial personnel relations were surveyed by Baker and Friedman (6) and by Baker (4, 5). Of sixty-one companies to which questionnaires were sent, only one anticipated a decrease in emphasis upon counseling after the war. In her studies of women in war industries and of the use of part-time workers, Baker developed a series of guideposts to assist companies employing women, either on a full-time or part-time basis.

In this era of high wages it is encouraging to learn from a survey of work incentives by Blum and Russ (11) that both men and women rated advancement and security ahead of salary. The hours of work were of least importance. Palmer, Purpus, and Stockford (38) described a study of 421 employees who left the Lockheed Aircraft Corporation. They concluded that the variables of sex, age, marital status, hours of work, security, and pay as well as the reasons given for leaving must be considered in the attempt to ferret out the real causes.

Programs in the Armed Services

Very few articles published under the heading of programs during this period can properly be termed research. Emphasis has been and, for the duration of the war, will continue to be upon better classification, reclassification, and selection of personnel with major stress upon testing procedures. The postwar period should produce constructive research studies based upon personnel procedures developed in the armed services. For this reason the following descriptive articles are noted: Bell and Altus (7), Faubion and Bellows (18), Hawthorne (24), Horchow (25), McCain and Schneider (32), McQuilty (34), O'Brien (37), publications of the personnel staff of the Adjutant General's Office (44), and Stover (45). Guidance in the Armed Forces Institute is described by Espy (17).

One article of considerable significance to those who operate civilian personnel programs is the study of a group of selectees released by the Army and reported by Ginzberg (20). Not one of these men saw action, yet their army experience caused certain ones, notably the semiskilled workers, to refuse to return to their former jobs. The day when those who have seen action come home foreshadows great occupational unrest. This study is suggestive of the type of service communities should be prepared to give returning servicemen.

Summary

The war has undoubtedly retarded the preparation and publication of evaluative studies of personnel programs. However, there has been rapid development of new programs and refinements of older ones, the evaluation of which must await the postwar period. Scientific evidence of the worth of guidance programs in educational institutions is always hampered by the fact that the very individuals who can best evaluate them are those who have pressing counseling and administrative responsibilities.

Research often becomes extracurriculum if attempted. The Eight-Year Study illustrates well what can be done when educators combine their efforts and when financial support is adequate.

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CHAPTER IV

Appraisal of the Individual

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Appraisal in Education ¹

Tests and Test Batteries

THAT standardized objective educational and psychological tests continued to be the most widely used approach to the appraisal of the individual has been clearly indicated by a general review of the research literature. Relatively few studies have been reported, however, in which the problem was the investigation of the validity or reliability of this approach, or which compare various methods of appraisal. Berdie (10) reported a study in which five counselors made judgments concerning twenty cases on which a wide range of test data was available. There was high agreement among the vocational diagnoses, and the report is valuable as an illustration of processes followed by counselors in synthesizing data of this sort, and making diagnoses and predictions. Dysinger (28) compared vocational diagnoses made by two counselors for a student, in which one relied entirely on a battery of aptitude tests without reference to achievement background or developmental data, while the other synthesized a wide range of data including achievement tests results, school records, expressed and measured interests, and appeared to arrive at a more satisfactory vocational choice. Generalization from a single case is unwise, but his description of the diagnostic process is a useful reference for the student of counseling. Sarbin (81) compared the predictive accuracy of case study methods with predictions made from regression equations using academic success as a criterion. Slight differences favoring the actuarial method appear to contradict a widely held view.

Test batteries have been used with success to distinguish differential characteristics of individuals who are successful in particular occupations or training courses. Selover (85) found that profiles, made from the American Council Sophomore Culture Test Battery results, differentiated successfully among thirteen major groups. Characteristic profiles were presented, and studies made of individuals demonstrated their value for counseling. Similar studies by Schneidler and Berdie (82) with beginning freshmen and by Seago (84) with students in teacher-training courses have been made.

¹ This section was prepared by Gordon V. Anderson. The author is indebted to Phyllis Morris and Jane Millen for assistance in reviewing materials; Edith Hyde, University of California at Los Angeles, and Georgia May Sachs, research coordinator, Pasadena, California, public schools, assisted in the initial assembling of biographical materials.

Numerous studies of the prediction of academic success were reported during the past three years. Excellent summaries of the findings of studies in the prediction of college success were made by Durlinger (27) and by Emme (29). Durlinger showed that the predictive power of intelligence tests has been increased and suggested that with increasing differential patterns in high-school programs the value of elementary-school achievement as a predictive variable will receive greater attention. Both summaries concluded that a combination of several variables yields the best results, and that prediction studies are validly applied only in the institution in which they are made. McGehee (66) stressed this latter point in a study of differential achievement among several curriculums in a technological college. He showed marked differences in mean test achievement and in predictive power of the variables for different major groups. Some index of high-school achievement as an additional variable in this study would have been interesting. Heston (56) demonstrated that nonverbal tests of ability have some relation to academic success, but he failed to clarify the specific contribution they made. Further research along these lines would be useful since counselors are often at a loss how to predict academic success for an individual for whom a verbal test would not be valid.

Three prediction studies in the field of professional training were typical of many. Cook (23) studied the predictive value of four tests for graduate students in education. Two gave good predictive results and the use of all four was found to be valuable for selection and counseling purposes. Differences were noted among major fields of concentration in education. Harding (48) applied special aptitude tests to entering students in architecture. His results indicated that "concrete intelligence" tests did not differentiate well, but that an aptitude battery of performance tests could be used that identified five out of six failures without eliminating any clearly able students. Bennett and Gordon (9) used two standard personality questionnaires with 235 student nurses and found them to have negligible predictive value. Since students from many schools were grouped together it is possible that differential characteristics among students within school might have been obscured. Kay (61) investigated methods used by medical schools for evaluating the personal qualifications of prospective physicians. That better methods of appraisal as a basis for admission to medical schools is desirable was clearly indicated.

Interview as a Method of Appraisal

No significant studies of the interview as a method of appraisal in education were reported in the past three-year period. Three studies in the fields of clinical and social psychology and social work may be provocative of application in student counseling. Using a standardized interview procedure in a study of the acculturation of second generation Italians in a New England city, Child (19) described methods which increased objectivity and made quantification of interview data possible thru separation and inde-

pendent classification and judgments of the recorded results. Total impressions were also taken into account. The method is too cumbersome for routine counseling, but is a useful contribution to research methodology. Buck (14) described a questionnaire for use in the interview thru which four areas of personality are investigated and evaluated: aspiration, emotional reactions, judgment and insight, and ethico-moral development. He described the procedure as standing between the free interview and stereotyped projective technics. Twenty-five cases seeking welfare assistance were classified by Hurewitz (57) according to degree of success in outcome, and factors from the initial interview which might have been prognostic were studied. Clear-cut differences were found. This useful research approach should be applied more widely.

Methods Based on Observation

The relation of grades to personality ratings of students made by teachers was studied by Norris (72), who obtained relatively high correlations. Marked sex differences were noted. Extent to which correlations might have been spurious, and methods used to insure objectivity were not reported. Smith (87) described a rating scale related directly to observable pupil behavior that was used with sixth-grade pupils. Her scale had not been completely refined, but this useful approach may well serve a double purpose of appraisal of the individual and evaluation of the educational program in view of its derivation. Frenkel-Brunswik (39) found a scale based on Murray's motivational concepts helpful in uncovering relationships and consistencies in personality. Anecdotal records obtained from six elementary-grade teachers were found by Hamalainen (Chapter II, 48) to throw light on pupil progress and adjustment. Certain limitations are noted in this approach which is most useful as a supplement to other appraisal methods (46).

Projective Technics

The Rorschach test continued to be the most widely used projective technic. Applying it on a large scale in a college guidance program, Munroe (71) found it useful to predict academic success as well as indicate personal maladjustment. Hertz (55) concluded that it was an effective tool in the clinical examination of the normal child or adolescent, altho she warned that inadequate norms and a lack of scoring standards make it a questionable research instrument at the present time, especially when used on children under ten years of age.

Using the Thematic Apperception Test, Sarason (80) found that in high grade, feeble-minded children personality problems and unconscious attitudes were revealed that were important in the proper placement of these children in the community. Haggard (45) has described a projective technic in which the child is encouraged to create stories dealing with his favorite comic-strip characters.

Analysis of Personal Documents

There is probably no area in which there is a greater need for objective and analytic methods than in the evaluation of such personal documents as letters, diaries, and autobiographies which, until recently, has depended on the subjective judgment of the clinician. The studies reported by Andrews and Muhlan (2), Baldwin (6), and Hadley (44) offer interesting objective technics for analyzing biographical material. The assumptions underlying Baldwin's personal structure analysis were that the frequency with which an item appears in the material may be used as a measure of its importance in the personality and that the contiguity of two items indicates relationships. To test the relative significance of the relationships found, Baldwin used the Chi-square technic, the appropriateness of which was questioned by Andrews and Muhlan who, in an extension of the Baldwin study, graphed the frequency patterns which were then compared and sorted into groups each of which had a unique pattern of frequencies known as congruent idea patterns. Both methods are time-consuming for the information gained, but they offer technics for the quantitative study of personal documents which, with further research, may uncover relationships rather than confirm or reject hypotheses already set forth by clinicians.

Case Study Method

Judging from the increasing literature on the subject of the case study method, one can infer that this method of appraisal has been growing in popularity. Seven case summaries presented by Marquit and Berman (67) illustrate how psychological technics are suited to the needs of the client and to the demands of the referring agency. An analysis of two case studies by Bellak and Jacques (7) showed how biological, psychological, and sociological levels of integration aid in gathering of data and understanding the dynamics of the case study. This study is more useful to the clinical psychologist than to the teacher-counselor. Martin's (70) study of parental attitudes described a standard question technic used in interview, to elicit responses helpful in diagnosis of child personality problems. This method revealed subtleties in the diagnosis of true parental attitudes. Much weight was given items that showed participation or a lack of participation in pleasurable home activities. The author admitted that his analysis was not complete, but it appears to be a thoughtful piece of work upon a subject of importance. Outline steps in making a case study were given by Good (43) in an article on case work with exceptional children. This is a useful reference for any case worker or counselor. Jones and others (59) reported a developmental case study of a boy from the age of eleven years to eighteen years of age. Emphasis was placed on modes of expression. Records of physical, motor, mental, and attitudinal developments were discussed as well as analyses based on projective technics and self-rating

scales. The use of the case study method in the elementary school was described by Finlayson (35) in a report of a study of educationally retarded but normal ability Negro children.

School Records and Report Cards

Hamalainen (47) reported a study of methods of evaluating growth of individual children in thirty New York schools. He mentioned cumulative records, report cards, continuous records, pupils' work records, anecdotes, profile charts, and other records as measures of growth. The author mentioned the value of specific statements from teachers as compared with general statements, and he recognized the necessity for a limited teacher load to permit increased record keeping and observation. An improved report card was described by Foreman (37). Allen (1) set forth excellent criteria for making a permanent cumulative pupil record. He emphasized cooperation of all staff members as necessary to the success of the project.

Check Lists and Self-Rating

Tschechtelin (107) described an effort to reframe the Kelly Personality Rating Scale in the vocabulary of the fourth-grade child. Marsh (69) studied the worries of college women. Most frequently checked were worries in the personality, academic, and social areas and least frequently checked were in home, physical, and financial areas. Harris (51) used self-rating in his study of play activities as a measure of delinquency in boys. Certain items in a long list of play activities were found to discriminate sharply between delinquent and nondelinquent boys. However, the overlapping of scores was so great that usefulness was probably limited to an indication of favorable or unfavorable trends.

Personality Tests, Questionnaires, and Standardized Measures

Weitzman (109) constructed a group test intended to appraise the social maturity of the individual. It was composed of items relating to overt behavior. It was administered to three different age groups and these groups were compared in tested maturity. This was a very thoro and careful study. A personality inventory of 239 items was described by Runner and Seaver (77). It is interpreted according to the theories of Freud, Simmel, Lewin, and others. Three hundred and eighty cases chosen from those tested were divided into five groups according to the rank on two basic factors. Comparisons were made between the five groups and between adolescents and adults, between men and women, and between well-adjusted and problem personalities. Marsh's study (68) of the diagnostic value of the Bell Adjustment Inventory suggested that the home adjustment scale is more useful in predicting social and emotional adjustment than are the social

and emotional scales, but that even this scale is not sensitive to cases of maladjustment until they are acute. Fourteen of the thirty-five home adjustment items seem more differential than the others. A comprehensive study of Harding (49) cumulated in a test that proposed to measure personal systems of values as they operate in influencing behavior. Certain areas of values are set up and under these classifications are listed problems and related value statements. Appraisal is made thru the student's method of solving problems. Noteworthy aspects of the test are the methodology and coverage. This work extends the areas of personality measurement. Arsenian (4) compared the scores on the Allport and Vernon Study of Values and scores on the Cleeton Vocational Interest Inventory. He found significant linkages between evaluative attitudes and vocational interests. Fischer, (36) using three measures of personality in studying the role of frustration in academic underachievement, found that students who had the greatest scholastic underachievement also had the most emotional maladjustment. Two matched groups of junior high-school pupils were compared by Anfinson (3) regarding certain tested personality characteristics. His findings indicated that in these groups maladjustment was not directly associated with nonpromotion. The study suggested that failure in school may be symptomatic and that causes are to be found in other areas.

Appraisal in Armed Services, Civilian Government, and Industry²

The large developments in research were in military and civilian government agencies. Because of the war there was an especially rapid development of research in the armed services. Civilian studies of aircraft pilots likewise became an important war activity and the research of the United States Employment Service was greatly implemented. There was relatively little development in Civil Service Commission. Research in industry was reduced because many research persons were in the armed services; also industry dropped much of its selection procedure making research appear less pressing. Experimentation with measures of vision for appraising job fitness was an important research development in industry.

During World War II all branches of the nation's armed services have employed research in individual appraisal for the improvement of procedures for the utilization and training of officer and enlisted personnel. Projects have been undertaken leading to the development, refinement, and validation of instruments and technics, including tests and test batteries, for use in classifying and assigning personnel. Research has also been applied to the evaluation and improvement of instructional methods and training aids, personnel rating systems, and the outcomes of training programs. Because of security restrictions, relatively little of this research has been described in civilian periodicals.

² This Section was prepared by Carroll L. Shartle and James A. McCain. J. B. Gillingham assisted in preparation of materials relating to research in the armed services

United States Army

Personnel research in the Army Ground Forces is the responsibility of the Personnel Research Section, Classification and Enlisted Replacement Branch, and Adjutant General's Office. Expanded work was under way in the Adjutant General's Office by 1940. Plans for personnel research were reported by Staff, Personnel Research Section (90) in which it was indicated that there was early need for an initial classification test to supplant the old army Alpha and Beta tests and for a mechanical and a clerical aptitude test. In 1941 the Staff developed the Radio Operator Aptitude Test which was an adaptation of a test previously constructed by the Signal Corps. The Staff also pointed out that as the number of men in the armed forces increased more specialized objective measures were necessary.

The Staff, Personnel Research Section (91) listed the tests developed for use in classification and assignment under the headings of classification tests, aptitude tests, educational achievement examinations, trade knowledge tests, and warrant officer examinations. The Staff outlined the steps in developing these tests beginning with a recognition of need for the tests in classification or selection. Problems in determining validity criteria were pointed out (92). The ultimate criterion for all military tests was behavior of the soldiers in the jobs for which they were trained, namely, combat. Obvious difficulties prevented the securing of such data and it was necessary to use other indexes of proficiency. The Staff further reported (94) two tests that were widely used in the selection of radiotelegraph operators. The Code Learning Test was found more reliable and showed greater validity than the Radiotelegraph Operator Aptitude Test Battery. There was little relation between years of education and ability to attain code speed. Musical instrument experience was slightly related to ability to develop code speed.

Plans for the development of tests for all A. S. T. P. courses were outlined by the Staff, Personnel Research Section (95). Research plans included both informational and functional tests.

The Staff described (96) research in developing a battery of tests to replace a road test for selecting truck drivers. Reliability coefficients and intercorrelations were shown for tests of vision including the Snellen Charts, Broken Circles, Telebinocular, and Field of Vision.

Broad analysis of various aspects of military personnel administration for both enlisted and officer personnel was made by Bingham (12). Classification testing problems and procedures, and test development were covered by Bingham (12), Churchill and others (21), and the Personnel Research Section AGO (95). The problems of training professional personnel to carry on a military classification program were treated by Bel-lows and Richardson (8) and Staff, Personnel Research Section, AGO (95). Some implications of the army classification structure and vocational guidance were presented by Evans (31).

Army Air Forces

The program of research in testing in the Army Air Forces was outlined by the staff of the Psychological Branch (97). The steps included the analysis of duties and functions of different air-crew assignments and the establishment of characteristics for which objective measurement was desired. Approximately two hundred tests were tried out experimentally.

The Staff, Psychological Research Unit No. 1, Army Air Forces, reported (97) four stages in its test development program: job analysis; test construction; experimental administration; and validation. The immediate objectives of the research unit were to develop methods for measuring certain human factors important in air-crew training and combat performance. These qualities included: resistance to distraction; freedom from fear of physical danger; endurance; motivation and interest; and other qualities. Sixteen assumptions were listed as basic in the development of tests in the areas of emotion, personality, and temperament.

The Staff, Psychological Research Unit No. 3, Army Air Forces (99) described research in the construction of tests in the areas of information, reasoning, judgment, foresight and planning, memory, reading comprehension, mathematics, physics, and mechanics. Tests with heavy verbal, intellectual factor loadings were not valid for selecting pilots but did show considerable validity in the prediction of navigator success.

The Staff, Psychological Research Unit No. 2, and the Staff, Department of Psychology, Army Air Forces (98) described twenty-five psychomotor tests which were used either for classification or for research purposes. An indication of the validity was shown for a few of the tests in measuring the aptitudes requisite of air-crew personnel. The most valid test for selecting pilots was the S. A. M. Complex Coordination Test (Mashburn).

The Staff of the Psychological Branch Office of the Air Surgeon described the aviation cadet qualifying examination (88). Verbal, interest, perceptual, and miscellaneous test items were used and the examination was constantly revised and improved. The most useful items were mechanical comprehension and a combination of kinds of information items used to measure interest. Perceptual tests showed appreciable relationship with performance in pilot training. Reading comprehension items were the most useful verbal items and correlated most closely with performance in navigator training. Graduation-elimination in flying training were used as criteria. On the basis of differential weighting of these tests, separate pilot, bombardier, and navigator aptitude scores have been derived on the basis of which a candidate is rejected or accepted and recommended for one of the specialized types of training. Complete records are kept on each individual who enters training, and systematic follow-up and validation studies thru training and into combat are made.

The Staff, Psychological Test Film Unit, Army Air Forces (100) outlined research projects in developing perceptual aptitude tests. The test media were paper and pencil group tests, motion-picture group tests, and

individual tests using apparatus. The tests were described but no reports are given regarding validity.

Cleveland, Faubion, and Harrell (22) studied two groups of weather observer students in the Army Air Forces and found evidence that an examination composed of mental alertness, meteorology, and physics questions significantly improved selection. Lennon (64) described a number of selection tests which were tried out by the Air Service Command to establish validity for selection of mechanical and clerical personnel.

Other Army Studies

Heath (54) reported a study of the validity of the rail-walking test which he indicated had proved useful in the Army as a gross instrument in diagnosing awkwardness and predicting trainability. Harmon and Dimichael (50) reported the development of the H-D Code Aptitude tests which, on a group of twenty-five students, showed greater validity than the radiotelegraph operator aptitude test.

United States Navy

The United States Navy employs systematic personnel classification procedures in selection for training, determination of appropriate duty assignments, and screening for emotional maladjustment. Eurich and McCain (30) and McCain and Schneider (65) described the Navy's program for selecting enlisted men for service schools carried on by selection departments in recruit training centers. The program utilizes pencil and paper tests; classification interviewing; and a permanent cumulative record form, the Enlisted Personnel Qualifications Card. Thomas (104) outlined the work of classification centers in receiving ships and stations employing similar personnel, and procedures in recommending enlisted men for ship-board duties. These programs are administered by the Classification and Selection Section of the Bureau of Naval Personnel. The *Training Bulletin* of the Bureau of Naval Personnel (16) discussed systematic procedures for determining suitable technical training schools and duties for naval officers established in indoctrination and midshipmen schools. These procedures employ interviewing officers and pencil and paper tests. The Officer Selection Unit of the Bureau of Naval Personnel administers this program.

Several articles in the *Training Bulletin* of the Bureau of Naval Personnel (15, 17, 18) analyzed research applied by the Test and Research Unit of this Bureau to the development, refinement, and validation of technics and procedures used in these classification systems. Projects undertaken by the Unit include: the development and validation of pencil and paper tests for ascertaining the qualifications of voluntary enlistees and officer candidates, and tests for use in selecting officers and enlisted men for technical training schools; determination of the validity of selection requirements for officer and enlisted technical schools such as age, extent of civilian schooling, civilian occupational experience, avocational skills, and evidences of leader-

ship; methods of assigning quotas for enlisted service schools; validation against school achievement of service school recommendations made by classification interviewers.

The *Training Bulletin* (15, 17) described contributions of the Unit to the improvement of naval training programs thru studies of curriculums and instructional methods and the development of achievement tests. The following are examples of these projects: comparisons between groups spending varying lengths of time in training; comparative evaluation of student achievement in schools of the same type; causes of attrition in training programs; prediction of teacher competence in training programs; analysis of mathematical concepts in an advanced technical school.

Naval Aeronautical Organization

Research has been applied by the Aviation Psychology Branch of the Navy to the following projects: development, refinement, and validation of a test battery for selection of aviation pilots and instruments and procedures for selection of air-crew men; evaluation and improvement of training aids and instructional methods in aviation schools; improvement of communications intelligibility; improvement of the night vision and day vision of personnel; evaluation and improvement of free gunnery equipment and cockpit design from the standpoint of effective utilization by personnel; and the prevention of accidents. For security reasons none of this research has been released for publication in civilian periodicals.

United States Marine Corps

The Classification Division of the U. S. Marine Corps has employed pencil and paper tests and test batteries developed by the Army and Navy in its program for classifying and determining suitable assignments for personnel. This division has applied research to the validation of these instruments and to other projects for the refinement of its classification program. None of this research has been released for publication.

Civilian Government

Since 1939 the Civil Aeronautics Authority has made funds available to the National Research Council for research in the selection and training of aircraft pilots. Extensive research of high quality has been performed on a number of problems including the appraisal of ability to learn to fly. Little has been published for release since Jenkins (58) outlined the program of research in 1941.

Research in the United States Employment Service progressed with the war needs. Shartle and others (86), commemorating the tenth anniversary of the program, described research in appraising the physical capacities of counselees by having the physician or counselor estimate an individual's physical capacities in terms of job performance and working conditions.

It is recommended for use in rehabilitation and is linked with a companion technic for appraising the physical requirements of jobs. Research was described in developing a new Part IV of the *Dictionary of Occupational Title* for appraising and classifying job seekers for "field" of work. An aptitude test for aircraft riveter and a counseling battery were discussed. Newly developed measures of skill were also discussed. The trade questions and work sample tests (aptitude test batteries) developed by the United States Employment Service were listed by Stead and Masincup (101).

Teegarden (102, 103) reported the test results of several hundred young adult subjects at the Cincinnati Employment Center. The tests used in the battery included the Kent-Shakow Industrial Form Board, Minnesota Special Relations Test, Minnesota Rate of Manipulation Test, and the Cincinnati Plier Dexterity Test. Percentile norms were presented. Most of the tests were skewed to the slow end of the scale. Sex differences were significant for parts of two of the tests.

Publications from civil service groups listed methods being used in appraisal but little research was reported in comparison to the need for validation of methods. Fearing and Fearing (33) reviewed certain theoretical implications of interviewing and reported a study of interviews conducted in the selection of public personnel. The traits most clearly differentiated by interviewers were education, experience, and summary evaluation. Freeman (38) experimented with a stress interview in selecting policemen. Ratings on a five-point scale showed fairly good reliability and also validity.

Powell and Levine (76) studied the reliability of civil service oral examinations and suggested the advisability of having two examining panels to increase reliability. Cozad (24) described the development of performance tests and gave information concerning reliability. Powell (75) outlined a procedure for developing and rating essay and service tests. Hawthorne (52) concluded that the development of multiple factor analysis was the outstanding achievement in test research in the last ten years.

Industry

The research from industry showed certain significant developments in appraising salesmen and in the use of visual measures in determining job fitness. One new alertness test was presented. Compared to the studies which are being made in the armed forces, the subjects used by industry are small samples and one wonders if the results will hold on a second sample in many cases.

Hay and Blakemore (53) presented distributions and minimum scores for selecting clerical workers in the Pennsylvania Company using the Otis Intelligence Test and the Minnesota Vocational Test for Clerical Workers. Ghiselli (40) examined the weights assigned the various tests in the United States Employment Service General Clerical Battery and reported that the tests in addition to the Minnesota Test for Clerical Workers added little to the battery. The battery, in addition to the Minnesota Vocational Test

for Clerical Workers, included number writing, arithmetic, and letter-digit substitution items. Dodge (25) administered a personality questionnaire to more efficient and less efficient clerks and found the more efficient less ready to assume responsibility, less at ease in social contacts, and more dependent upon others than the less efficient clerks. Good clerks seemed to possess traits opposite of good salespersons. Jurgensen (60) reported the development of a test for selecting and training industrial typists. Validity was based on sixty-seven employed typists who were divided into two criterion groups.

Ghiselli (41) studied twenty-six inspector-packers in a pharmaceutical supply house. Of the several tests administered the Minnesota Paper Form Board had the highest validity. Drake (26) described his experiences with the work sample type of tests in industry. He disagreed with present standards for determining validity of tests. Blum (13) studied fifty sewing machine operators and found the tracing subtest of the MacQuarrie to have the highest validity of the tests used.

Owens (74) reported a study of fifty-seven women personnel executives in service, retail, and manufacturing concerns. In picking staffs these executives placed emphasis on education, personality as revealed in interviews, and aptitude for handling people. Ninety-one percent of the executives had completed at least three years of college and the kind of training and experience was quite varied.

Fay and Warren (32) studied the relationship between sales ability and the transcribed voices of salesmen. Ryan and Johnson (79) in a study of salesmen and of servicemen found that for both occupations, the Strong Vocational Interest Blank did not differentiate between good and poor employee performance. But when the weights were developed on a basis of comparing upper and lower groups good differentiation was obtained with some evidence that the weights would hold on a second sample. Churchill and others (21) developed an interest test especially for route salesmen and for mechanics. The scores differentiated the two groups significantly and held up on a small second sample.

Ghiselli (42) gave twenty-nine casualty insurance agents the Strong Vocational Interest Blank and the Pressey Senior Classification Test. Interest ratings of CPA and occupational level and the classification test scores showed appreciable correlations with job proficiency.

Kirkpatrick (62) pointed out the difficulties in establishing a criterion of success for salesmen and suggested five areas of future research including criteria, job analysis, studies of sales situations, experiments with the use of projective technics, and tests for areas of conflict which lead to poor adjustment.

Ohmann (73) reported thirteen valid personal data items from the application blank and listed ten qualifications for salesmen. Bills (11) reported three tests which fell down for selecting salesmen. These tests were a name and number checking, a test of dominance and extroversion, and a tempera-

ment test. Viteles (108) reviewed progress in appraising sales ability and reported a study indicating that the Humm Wadsworth Test was not suitable for selecting salesmen.

Tiffin (105) gave considerable attention to visual problems in industry and emphasized the necessity for utilizing tests of vision in placement. He showed existence of relationships between visual test results and proficiency in assembly and clerical work. Some relationship was shown between supervisors' ratings of 6000 steel workers unclassified as to occupation and visual tests. Ayers (5) reported that a battery of visual tests showed high validity with various success criteria for textile inspectors. Diagnostic stereopsis and binocular fusion measures were the best of nine vision tests which showed validity.

Ferguson (34) studied the effect of retesting with L. O. M. A. mental alertness test and found the mean increase to be twelve points with those hired by the company increasing slightly more. Schneidman (83) suggested a method for the experimental study of the problems of the appraisal interview. Tiffin and Lawshe (106) described a new mental alertness test and showed evidence of its validity for clerks, electrical trainees, and inspectors. Rusmore (78) reported the development of a new pegboard test.

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CHAPTER V

Counseling

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FOR THE first time in the history of these reviews, there is sufficient research in the *process* of counseling to justify a separate chapter dealing with the face to face situation thru which an effort to alter attitudes, choices, and behavior is made. The instruments of appraisal and diagnosis are covered in other sections. This chapter deals with the general formulations of significant hypotheses in counseling, with objective studies of the process involved in interviewing, with research regarding outcomes, and with a variety of new developments challenging further research.

General Formulations

Several general descriptions of the counseling process have illuminated different points of view and raised significant issues which can be resolved only by objective evaluation. Rogers (29) has set forth in a volume on counseling a viewpoint which provides many hypotheses for testing. According to this view counseling consists of a definitely structured relationship, highly permissive in nature, in which the client finds an opportunity to explore, freely and without defensiveness, his difficulties and the emotionalized attitudes which surround them. As a result of this exploration and catharsis the client gains an understanding of himself which brings his behavior within the sphere of his conscious control, and enables him to take positive steps in new directions in the light of his new orientation. The counselor's role in this process is not to offer a solution to the client's problems, but to assist the client to see himself more clearly in all his negative, positive, and contradictory aspects in order that insight may develop. To this end the counselor's major technics are the acceptance of client attitudes, and the accurate reflection of them. The statement of these views is consistent and clear and provides many principles which, while sharply opposed to traditional counseling, are thoroly susceptible of proof or disproof. Some of the research which has been stimulated is treated in the following section.

A similar point of view has been formulated by Allen (2) who, dealing with the problems of children, has placed his stress upon helping the child to grow and mature psychologically and to become an independent person in his own right. The therapist begins where the child is and seeks to help him to draw upon his own capacities so that he may arrive at a more creative use of himself. The therapist deals with the child as he is revealed in the immediate present of the counseling relationship, not with the past. Allen's book is particularly strong in pointing out the philosophical roots of this viewpoint in Otto Rank and G. H. Mead, and the philosophical

implications. His stress upon "the creativeness of human difference" and the value he has placed upon the struggle of the personality to differentiate itself from others are basic formulations which should result in fruitful hypotheses.

Very different in orientation is the presentation by Darley (13) of counseling in the high-school guidance program. Simply written for a teacher audience, the book has indicated clearly the author's basic view that counseling has as its purpose the giving of information to the student and the modification of the student's attitudes and beliefs by the counselor. As stated by Darley, a part of the purpose of counseling is "to sell the student certain ideas about himself, certain plans of action, or certain desirable changes in attitudes." Counseling is also conceived of as a learning process for the student and as a place for emotional release, tho this latter aspect receives little attention. The author has presented his point of view with logic, starting with a discussion of tests and statistics, since the counselor must know the individual's capacities, aptitudes, and personality traits, if he is to guide him effectively. Having arrived at a basic and fitting explanation of the student's difficulties, the counselor, thru procedures which gain rapport but keep control of the interview, endeavors to make the specific suggestions which will be helpful, checking up later to see that the student has done his part.

It is difficult to exaggerate the differences in viewpoint between traditional counseling, as represented by Darley, and the client-centered or non-directive approach advocated by Rogers and by Allen. Research must provide the final answer, perhaps in some as yet unformulated frame of reference. Meanwhile, the difference will undoubtedly promote constructive effort to study this whole field.

Other formulations have also been produced during the three-year period. Garrett (17) wrote from a social worker's point of view. Basically her position is somewhere between the client-centered and counselor-centered viewpoints described above, and one finds contradictory statements regarding the value of self-initiated action alongside of statements of the way in which the counselor subtly leads and directs the interview. Her book is, however, rich in practical suggestions and gives evidence of a psychological understanding of human nature.

Shoobs and Goldberg (34) have written a book which is based entirely upon the views of Alfred Adler, rather rigidly presented. It supplies a definite formula for understanding each child, based on a set outline for analysis, which supposedly reveals the child's life style or goals. Counseling treatment consists largely of interpretation of this material to the child, using various technics to gain rapport. The views and methods are those advocated by Adler twenty years ago and tend to be presented slavishly rather than with creative changes and adaptations. Levine (23), in a superficial book concerning psychotherapy, covered such diverse approaches as reassurance, occupational therapy, authoritative firmness, hypnosis, and shock therapy, each rather inadequately.

Research in the Process of Counseling

The fluid interaction of the counselor and counselee in the interview has long been considered to lie solely within the realm of artistry and to be unapproachable by scientific methodology. This situation has been sharply altered by the appearance of a number of solid studies which attack directly, by objective means, the process which occurs in counseling contacts.

Lewis (24) was the first to publish a study of this sort. She undertook to explore objectively the counseling interviews with eighteen girls whom she had seen for an average of twenty-four interviews apiece. More complete analysis was made of six cases. By examining the approximately verbatim records, categories were developed for the girls' and the counselor's responses. Graphs were plotted to show the changing proportion of these categories thru the course of treatment. Comparability was gained by plotting the total course of interviews in deciles. The major finding was that a definite process is discernible in the responses of the girls. Facts and attitudes relating to the problem reached a peak in the second decile. The recognition of causes of behavior, of relationship between different aspects of behavior, reached a peak in the eighth decile. Making plans for self, and reporting on results of steps taken, reached a peak in the tenth decile. The study was an original and suggestive one. Its weaknesses were that no study of reliability of the procedure was made, the material was only approximately verbatim, and the categories were not too clearly defined.

Snyder (35) has made a similar study which corrected these defects, and is to be regarded as a somewhat definitive study of one approach to counseling. Taking six cases counseled from the nondirective viewpoint, in which thirty of the forty-eight interviews were recorded phonographically, Snyder developed seventeen carefully defined categories of counselor response, twelve categories for classifying the content of the client response, and nine additional client categories in the dimension of feeling or emotionalized attitudes. Reliability was indicated by the fact that 70 percent of the items were reclassified in the same category after a month interval, and another judge classified 60 percent in identical categories, 74 percent in the same general category. Snyder's findings indicated clearly that the unstructured material of the interview can be objectively analyzed. He corroborated the findings of Lewis that successful counseling is an orderly process with statements about the problem dominating early contacts, self-understanding and insight rising in the middle and later contacts, and choices, decisions, and plans rising sharply in the concluding interviews. There was a marked tendency for the negative feelings characteristic of the early phases of counseling to change to ambivalent and positive affective states as counseling progresses. Another significant finding was that the nondirective counselor used, in general, the nondirective technics which he claimed to use. Responses which reflect or clarify attitudes and responses of simple acceptance made up 58 percent of the counselor statements, while direct questions comprised 5 percent of the responses, and suggestions and advice

constituted but two-tenths of 1 percent. Study of the sequence of responses showed that clients tended to reject such directive responses by the counselor as interpretation, persuasion, and disapproval.

Raimy and Curran have pursued still further a study of the changes which occur in client-centered counseling. Raimy (28) investigated the client's concept of himself as revealed in the references which he makes to himself in counseling interviews. Carefully defined categories of positive, negative, and ambivalent self-references were set up and applied to fourteen complete verbatim cases. The reliability of the classification procedure was shown to be above 80 percent complete agreement, whether based on reclassification after a six-month interval or a three out of four consensus of four judges. In cases where outcome was successful as judged by the client, counselor, and supervisor positive self-references tended to increase steadily, and negative and ambivalent self-concepts decreased almost to the vanishing point. This was not true in unsuccessful cases. The author interpreted these findings as indicating that the way in which the individual perceives himself may account both for the rigidity and inflexibility of personality and behavior in situations where environmental pressures are shifting, and also for the surprising fluidity of personality and behavior in situations such as the counseling relationship. This study opened the door to a new mode of evaluating outcomes in counseling that may help to settle the perplexing problem of criteria.

Curran (11) has made an exhaustive analysis of the process of therapy in one case, nondirectively counseled, in which twenty interviews were recorded. Three judges rated independently all responses in each interview as to elements of negative and positive emotion, insight, and choice. An analysis was also made of the problems brought out in the interviews. It was found that various types of negative emotion tended to decrease and insight tended to rise thruout the contacts. Furthermore, problems were gradually perceived as having more and more interrelationships. As these relationships were observed by the client the number of problems discussed decreased, and a clearer and more unified view of the self became evident. These studies make possible the objective comparison of different approaches to counseling. Gump (19) has made a start in this direction by comparing the counselor technics in one psychoanalysis with counselor technics which Snyder (35) showed to be characteristic of nondirective psychotherapy. The psychoanalysis was phonographically recorded—424 interviews—and the study was based on a randomly distributed sample of forty-four interviews. It was found that 35 percent of the analyst's responses were classified as interpretation, 14 percent as direct questions, with other types of response very widely scattered. The pattern of counselor procedure was shown to be very different from that of nondirective counseling with about three times as much use of directive technics. This type of objective description of counselor approach lifts discussion of differing approaches out of the realm of argument and into the area of factual consideration. Altho Gump restricted himself to the pattern of counselor

procedure, there is no reason why technics similar to those used by Snyder, Raimy, and Curran should not be used to evaluate changes in the client as well, and thus to clarify, upon a scientific basis, the question as to whether one approach or another produces more desirable results.

Haggard (21) has attacked, in a thoroly experimental manner, the basic problem of assimilation of traumatic shock by the individual, a study which has significant implications for further research. A sharp electric shock was administered to eighteen subjects. Three different "therapies" were instituted. The first was simply rest and relaxation; the second, experimental extinction, was a repetition of the whole experience without the administration of a shock; and the third was a catharsis and information experience in which subjects were encouraged to talk out their reactions, and their questions were answered. It was found that the third type of therapy was most effective in reducing the measures of physiological tension when the experience was repeated and the shock readministered. In general, the more conscious knowledge there was about the whole experience, the less the disturbance. This was a valuable type of experiment, carefully conducted.

A study of the process of therapy in a school setting has been reported by Baruch (5). Out of seventy-two children, one-third were judged to be maladjusted, and release therapy, in groups and alone with teacher-counselors, was provided. The account of play technics and of the ways of handling feeling makes this a significant study for educators, altho it is only partially objective.

Two contributions to methodology have been published during the period under review. Porter (27) has shown that counselor functions may be reliably rated either by examination of typescripts of interviews, or by listening to a phonographic recording. Findings of this study were reported in the *REVIEW OF EDUCATIONAL RESEARCH*, February 1942. Covner (10), in a series of reports, has examined with thoroness the technical problems involved in phonographic recording, and has compared the counselor's written report of the interview with a phonographic recording. While less than one-third of the interview appeared in the written report, it was found that accuracy tended to be high, and that training, particularly in nondirective counseling, made the reports significantly more complete.

Some studies of results of counseling have appeared. Baruch (6) has examined her counseling contacts with forty-seven teachers in training, seen for an average of seven interviews apiece. Half were regarded as very maladjusted by the staff. After analyzing the problems presented, the author gave the final rating by the staff, which showed that 87 percent of the group had improved. The students expressed relief and satisfaction with their own progress in 85 percent of the cases. Altho the objectivity of the evaluation was diluted by the fact that the counselor was a member of the staff making the initial and final ratings, this study is a significant attack upon the problem of measuring results.

Bronner and Schwartz reported follow-up studies of child guidance cases. Bronner (8) found that out of 650 cases seen at the Judge Baker Guidance Center, 82 percent had favorable careers five to eight years after clinical treatment of parent and child. Other resources, in addition to therapeutic interviews were used. Schwartz (33) found in a study of thirty-two cases that success was much more likely where the mother desired to participate in the treatment process, rather than turning the child over to the clinic. Oberndorf (26) endeavored by questionnaire to get analysts' evaluations of their own success, finding some agreement on criteria of success but little agreement on other points. The weakness of the technic is apparent. Aldrich (1) reported a study, using a control group, in which social adjustment was measurably improved by special efforts put forth by the counselor.

Publication of Cases

Progress in counseling research can come only as there are complete and adequate data from which to work. It is encouraging that a number of interviews and cases have now been published in complete form. Rogers (29) was the first to publish, in his book, a complete phonographically recorded counseling case including eight interviews. Snyder (36) has also published a full case of five interviews, approximately verbatim from very complete notes. Sargent (31) presented and discussed a full report of a single counseling interview, and Curran (12) gave a phonographic recording of a first interview, discussing the way in which the interviewing relationship develops its psychological structure. Gardner (16) has done a real service by presenting a dozen brief cases from industrial counseling, all of them in approximately verbatim form. Axline (4) gave verbatim excerpts from four cases handled therapeutically by a teacher in a classroom situation. Rosner (30) presented some recorded interviews by military psychiatrists, largely concerned with diagnosis. The significance of all this case material presented in full is that the vague and generalized discussions of counseling will increasingly be replaced by studies of procedure, process, and results based upon the raw material of the interview itself. If photographic records are added to phonographic records, posture and expression can be studied as well as words.

Use of New Technics and New Materials

Implications for research are contained in the many suggestions made for the use of new media in therapeutic contacts. It is clear that counseling can no longer be limited to purely verbal materials. The language of play was discussed in a number of references (3, 9, 22, 32) selected from a much larger group. Comic-strip characters (20) and office equipment such as the dictaphone, telephone, and typewriter have been used therapeutically (15). Brigden (7) discussed such procedures as storytelling, letter writing, and

symbol destruction as ways of releasing emotional tension, and described "reversed authority" in which the therapist plays the part of the child. Even a rating scale such as the Vineland Social Maturity Scale has been used as a basis for emotional release and self-analysis (14). Toeman (37) gave a full account of one case in which dramatic role-taking in the psychodrama was utilized as both a group and individual technic. This is a method which might be adaptable to school situations.

General Discussions

Of the many general articles regarding counseling only four are selected for mention, because of their interest for the research worker. Thus far the war has brought out little research in the field of counseling. The most notable exception is the work of Grinker and Spiegel (18) reported also in restricted military publications, dealing with therapy of war neuroses thru seminarosis, followed by brief psychotherapy of a more conventional sort.

Past and present trends are significant signposts for research. Lloyd-Jones (25) surveyed college personnel work and counseling for the past decade, suggesting that the mechanistic and test approach is decreasing in favor of a dynamic approach. One journal devoted a whole issue to the present status of "Psychotherapy and Education" of which the article by Williams (38) pointed up issues for research, while Zachry (39) portrayed the relationship between therapist and school. Even more significant than the articles themselves is the fact that educational and psychological journals now consider it timely to devote whole numbers to therapeutic counseling. This trend is likely to continue and to become more pronounced.

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CHAPTER VI

Guidance thru Groups

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THERE is still lack of clarity with respect to (a) the processes that naturally go on in groups, (b) group work, and (c) group therapy. It has been helpful to the writers to think of *the experience of being in a group* as the raw material from which the group worker, thru his active participation, helps the members to extract personal and social values; *group work* as essentially an educational developmental process; and *group therapy* as a therapeutic or curative process, oriented to psychiatry and serving emotionally disturbed persons. The writers also recognize therapeutic aspects of group work and educational aspects of group therapy.

In the present state of disagreement as to the nature of group work, this area of research is particularly difficult to delimit. On the sociological side of the boundary are investigations of the nature of groups, such as the classification and description of the dyad (two persons who have an established pattern of interaction) by Becker and Useem (5); the two-year study of ethnic groups in Connecticut based on two thousand interviews and life histories collected by means of the free-association technic (29); and the laboratory study of mob behavior by Meier, Mennenga, and Stolz (22). In the bordering psychological regions may be found investigations of attitudes of students and industrial workers and analyses of civilian and military morale, many of which emphasize the social factor and satisfaction in congenial contacts and working conditions as essential ingredients in morale (12, 38). The adjacent psychiatric area, which includes group therapy with seriously disturbed children and play therapy in small groups in mental hospitals, clinics, and social agencies, was reviewed in another issue of the REVIEW OF EDUCATIONAL RESEARCH (32). Interwoven with group work is the counseling process. Wilson (41) did much to clarify this relation in her book *Group Work and Case Work*.

During the past three years, the references in bibliographies on group activities (10, 33) have still been predominately descriptions of programs, summaries of procedures, and theoretical discussions. However, more detailed descriptions of the group-work process have appeared as, for example, the detailed records of successful group-work projects in classrooms, camps, and communities in the book by Baxter and Cassidy (4) and the report by Brunner (7) of an "experimental project in social engineering" for the purpose of "meeting the needs of rural youth through existing agencies and organizations."

The most significant trend in research in this field is the shift from descriptive studies to what Lewin has called "action research" on groups—the "study of experimentally created changes." In this chapter several

examples of the still predominant types of survey of student activities will be mentioned; reference will be made briefly to the study of relationships between participation and scholarship; and experiments in changing group structure, atmosphere, and behavior will be more fully reported. Reports of the application of sociometric procedures, studies of group discussion, and analysis of leadership and experiments in leadership training will also be included in this chapter.

Surveys of Present Practice and Opinion

These surveys are of value so far as they represent procedures and critical thinking growing out of the exigencies of numerous situations. Two bulletins of the National Association of Secondary-School Principals (2, 16) gave descriptive accounts of student activities and information on current trends and problems. A trend was evident toward the recognition of the positive contribution of these activities. Among the reasons given for failure of student activities in high school were the following: adoption of the form of administrative machinery of a group-activity program without real understanding of its values and of the ways and means of realizing them; lack of confidence in pupil's ability to plan, to make intelligent decisions, and to accept responsibility; participation by too few pupils; overemphasis on competitive aspects; lack of vital relationship to the curriculum and the community; inadequate evaluation; lack of teachers equipped with technics of group work; and failure to adjust teachers' loads to their informal group responsibilities. On the basis of a survey of the activities in the North Central Association high schools, Trump (36, 37) reported many of the same inadequacies and made similar recommendations.

Relation of the Participation in Student Activities to Scholarship

A recent study (27) of the relationship between participation in student activities and scholarship confirmed the conclusion from previous investigations (31) that college students engaging in extracurriculum activities maintain as high or higher scholastic average as do comparable nonparticipating groups. Exceptions to this generalization are found among those participating excessively and those participating in sports. Men in the upper fourth scholastically participated in intramural athletics much less than those in the lower fourth. Congdon (9) found that the group of students holding three offices were superior in scholarship to all other groups. She concluded that there is no evidence supporting the practice of restricting, on the basis of scholarship, the number or kind of offices held.

Experiments in Changing Group Structure, Atmosphere, and Behavior

Research on the influence of the leader's behavior and other conditions within the group on the responses of members has great practical signifi-

cance. Wright (42) applied a modification of the experimental method that Barker, Dembo, and Lewin used in studying frustration and regression to thirty-nine pairs of children three to six years old in a free-play situation. He found an increase in the cohesiveness of the groups under the influence of frustration. The amount of time spent in cooperative behavior increased, and the amount of time spent in conflict behavior decreased. The children whose friendship was strong showed a higher level of constructiveness and more cooperative behavior, less conflict, and more violent aggression against the experimenter than did weak friends. Rebellion against rules of conduct occurred mainly when children were together. There was an indication, however, that some kind of regression in the level of maturity of social interaction took place under the influence of frustration.

Experiments with housewives (17) and with college students (40) showed that lectures, discussions without decisions, and requests were less efficient in changing specific food habits than group decision. After group decision, the members were ready to cooperate in eating the food recommended, largely independent of personal like or dislike. "The goals set were for the group as a whole or for individuals in a group setting," not for individuals as individuals. "The experimental studies indicated that it is easier to change ideology or cultural habits by dealing with groups than with individuals."

Experiments in industry under controlled conditions (30) have demonstrated that "democratic procedures may raise group efficiency." A substantial permanent increase in production resulted from certain methods of "team decision."

Group Technics

Sociometric procedure—The sociometric procedure has been employed in many forms and in many different situations. Brown (6) summarized the steps involved in the procedure, its limitations, and some of its values in "getting representative membership on community councils and committees," and in "finding potential leaders." It is important that sociometric tests have "reality value"; in other words, that the subjects have confidence that something will be done about the choices they make. This element of reality distinguishes the sociometric test from the personal-preference questions employed by Elliott (11) as an aid to the social development and social adjustment of elementary-school children. The directions were as follows: "Will you write down the names of your best friends? Since there isn't room for very many names, you must choose your very best friends. . . ." Sociometric constellations based on the children's responses showed both "the mutually recognized friendships and the directions of the children's hopes and aspirations in regard to friendships." The analysis of children's friendships in a classroom may serve to guide the teacher in providing opportunities for friendly relations, for developing social skills, and for building a sense of competency. The sociometric technic, however,

should be used only in combination with all other available sources of understanding the individuals and the group. There is danger of oversimplification, of making important decisions on the basis of the results of these friendship charts alone. Some one element in the situation may markedly influence choice. In a study of social relations in the college fraternity Vreeland (39) found "a large and persistent skew in the preferences of members of the different classes for one another."

In a self-help community center (8) sociometric technics were employed to acquaint members with the structure of the group and thus bring about a more harmonious coordination of effort. Two tests were administered: the first simple—"With whom would you like to work on the Social Committee for the Mother's Day Program? List first, second, and third choices"; the second more complicated—"With whom would you like to work on the _____ Committee?" and "With whom would you prefer not to work on the _____ Committee?" By means of the choices thus obtained, real leaders for different kinds of activities were identified and members were helped to form work-groups that functioned more harmoniously and efficiently. By making an analysis of the work situations themselves, as well as the interpersonal relations, the administrator learned what kinds of interpersonal relations were required for various tasks.

In a summer camp Hunt and Solomon (14) asked these questions of boys ranging in age from five to eight years: "(a) Whom do you want to sit beside at table? (b) Whom do you want to sleep beside? (c) Whom do you like best?" The boys gave the name of a single person in answer to each of these questions. These personal preferences were compared with personal data and counselors' rating to ascertain stability of group-status and correlates of group-status. Instability of choice was characteristic of the first four weeks; stability, of the last four weeks. The large percentage of change occurred in the first week. "Previous experience in camp, athletic ability, generosity, physical attractiveness, orderliness of activity, and lack of egocentricity were found to be significantly correlated with group-status. With time in camp the correlation between group-status and . . . athletic ability decreased, while those correlations between group-status and behavioral traits increased." Howell (13) aimed to find some measure of intensity of acceptance or rejection in the choices of college students. Similar reports of applications of sociometric technics, too numerous to include in this chapter, are found in recent volumes of *Sociometry*.

The most important contribution to the development and application of sociometric procedures is *Leadership and Isolation* by Helen Jennings (15). The subjects were 236 girls at the New York Training School for Girls, 133 of whom were studied intensively. Two technics were used, both preceded by an informal discussion during which the plan was agreed upon and clarified by subjects and experimenter. The first technic called for the names of girls anywhere on the campus whom the subject would prefer to live with, work with, enjoy leisure with, study with, and those whom they would prefer not to live with or to participate with in the activities men-

tioned. All the subjects had to do was to write the names in the appropriate boxes marked "yes" and "no." The second technic was a social-contact listing or "test." On this sheet the subject wrote the names of girls not living in her cottage with whom she had had contact (defined as "another person you take trouble to speak to, not including persons who may have spoken to you and to whom you therefore *had* to reply") and the approximate number of contacts she had had. The first tests were given during the last week of December 1937; the retests, the first week of September 1938. These data were supplemented by excellent case studies and verbatim reports of remarks made by girls about others. This research represents a most thoro analysis of the choice processes over a period of eight months. Thru the statistical analysis and even more from the personality pictures of girls chosen by few and rejected by many and girls chosen by many and rejected by few or none, the reader obtains insight not only into social structures but also into the dynamics of personality and interpersonal relations. It is encouraging that positive feelings were reported more frequently than rejections and that these girls, without special opportunities to develop insights, made sound and socially constructive choices. For the first time the relationship between social status in the group and the actual dynamics of the situation and the interpersonal relations was studied. Jennings (15), thru this and other research, has developed the sociometric method, originated by Moreno, into an important tool of sociological analysis applicable in education, community relations, and industry.

Group discussion—This important method of group work has recently been subjected to little experimental study. Robinson (28) set up experimental and control discussion groups to ascertain the effects of group discussion upon the attitudes of college sophomores toward war and capital punishment. He administered Thurstone attitude scales before and after the discussions. All discussion groups showed significant changes of attitude. The greater range of shifts was made in the direction of the initially strong attitudes. Shifts of opinion from reading were greater than those produced by group discussion, but discussion tended to shift persons in the opposite direction from the change made after reading. Larger shifts were made by men and were associated with low emotional stability and less information. Another investigator (34, 35) found the "discussors" to be superior to the nondiscussors in comprehension of a passage, even when the possible influences of averaging and majorities were allowed for.¹

Applications of mathematics—Rashevsky (24, 25) has continued his studies in mathematical theory of human relations, attempting to reduce to formulas the complexity of individual behavior as influenced by and influencing other members of the group. One might question whether this

¹ Descriptions of group psychotherapy with psychoneurotic soldiers, a report of a group therapy round table, and of an experiment in group therapy with shy adolescent girls are included in the October 1944 issue of the *American Journal of Orthopsychiatry*. Articles dealing with "The Human Relations Class" as a preventive mental hygiene program for schools appear in the October 1941 and October 1944 issues of *Understanding the Child*. Evaluations of courses in occupational information and vocational guidance are reported in Chapter II of this issue of the REVIEW OF EDUCATIONAL RESEARCH.

translation of relationships into mathematical form adds anything to a clear verbal statement of the relationship.

Leadership

In marked contrast to the psychometric method of studying leadership presented most ably by Link (18) are several new approaches that deserve special mention. Murphy (23) described leadership as an influence in the total group. According to this point of view, leadership is "that element in a group situation which, when made conscious and controlling, brings about a new situation that is more satisfying to the group as a whole." By means of the sociometric technic, those individuals who are centers of influence may be located; by means of the job-analysis technic, the situational components of leadership may be ascertained. Manson and Freeman (21) used the job-analysis technic as a guide in selecting young men eligible for Austin scholarships, who were then rated on fourteen qualities.

Redl (26) approached the study of leadership from the psychoanalytical point of view. He described ten types of leaders in terms of the emotional relationships of the leader as object of identification, as object of love, and as ego support.

Experiments in the training in democratic leadership have been conducted by Bavelas and Lewin (3) and Lippitt (19). The procedure used by the former was to observe and rate six leaders in a summer "home camp" before and after a period of training. Marked improvement in group atmosphere, attitudes, and technics was obtained. Individual leaders changed as much as from 77 percent to 4 percent in authoritarian methods. A follow-up made four weeks after the training had ended showed the persistence of the training. The retrained leaders improved in teaching methods and markedly in morale. Zander and Lippitt (43) described the use of the psycho- or socio-dramatic technic in the training of leaders.

Needed Research

The trend toward experiments in which the effects of specific changes in group-work procedure are studied with precision should be continued. Classrooms, clubrooms, and camps may be converted into "observational laboratories." Thus the effect of different group-work technics and different leadership behavior on members of the group may be studied scientifically. For example, a teacher, who has two classes that have been equated with respect to chronological age and results of intelligence, achievement, and sociometric tests, may keep constant all conditions except the degree of directive behavior she shows in the two classes. In one class she acts as director, expert, critic, information-and-direction-giver, and in the other, primarily as group leader, being less directive and encouraging more pupil-teacher planning. At the end of the experimental period the two groups may be compared with respect to amount and kind of achievement,

verbal responses, quality of social and emotional responses, and interpersonal relations.

The fruitful experiments in industry, giving insight into channels and technics for developing cooperative relationships, should be conducted under varied conditions, so that generalizations as to what to do and how to do it may be made. More can be learned about the dynamics of interpersonal relations by a combination of sociometric procedures, case-history data, and comments and introspective reports relating to the behavior of others and how it affects the individual reporting.

A synthesis of approaches—educational, sociological, psychological, psychiatric—is necessary for the improvement of group work. The understanding of the nature of groups, the complex reciprocal relations between work with individuals and work with groups, the equally complex relation of a particular group with other groups in the school and community—all are fundamental to the development of better group work and have a bearing on many practical problems. The validity of many kinds of group experiences such as “human relations” classes and classes in occupational information should be determined in a much less superficial way than is being done at present. The lively discussion of these aspects of group work should eventually be reenforced by research that will replace suppositions with fruitful hypotheses and proved facts and generalizations.

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CHAPTER VII

Educational and Vocational Information

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DURING the period from September 1942 to September 1944, many researches in the field of educational and vocational information were completed, and large scale research projects carried on by the U. S. Government agencies became available. Those emanating from government agencies and bureaus employing thousands of individuals to collect and process data were so voluminous and far reaching as to deserve first interest of guidance and placement officers and classroom teachers. Space limitations, however, prohibit more than a brief discussion of certain of these government projects that are especially useful to educators. The researches covered are published mainly by five agencies of the U. S. Government: Bureau of the Census, Bureau of Foreign and Domestic Commerce, U. S. Civil Service Commission, U. S. Office of Education, and War Manpower Commission.

The uninitiated will find that considerable time and patience are required to extract usable information from the mass of statistics and findings published by the U. S. Government and bound in large volumes. It is hoped, however, that with the assistance of this review the work of identifying appropriate material for guidance and placement purposes will be considerably reduced.

The publications mentioned are available in city libraries or thru the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Those selected should prove of particular value not only to research workers but also to counselors, personnel workers, employment officials, deans of students, teachers of occupations classes, curriculum planning committees, and others who use research findings in their work.

The 1940 Census

Basic data for many types of researches are furnished by the Sixteenth Census. A considerable amount of significant information about occupations, working conditions, earnings, industries, employment trends, and other features of vital interest to counselors is available to those who know how to locate data to be used in guidance programs. Probably one reason why counselors in the past have not made maximum use of the findings of the Bureau of the Census is lack of information about census publications outside of the brief summaries to be found in the Statistical Abstract. The Bureau's index of publications alone requires twenty-three pages for listing, and from this list those important for counselors are mentioned in the bibliography for this chapter. Several agencies, both public and private,

are undertaking the task of reinterpreting some of the data for school use, and in 1945 some of these interpretative studies should be available.

Much of the 1940 Census data became available during 1942-44. Altho the census was taken during March 1940, many months were required for the work of collecting the returns, organizing materials, tabulating data, and printing. It was not until 1942, therefore, that information was released concerning the labor force and occupations in which workers are engaged.

Limitations of Data

Census material is considered the best comprehensive data in the field of occupations, but there are certain limitations that must be recognized. Census data are obtained by enumerators who go from house to house collecting information. Often the worker himself is not present, and information about him and his work is supplied by other members of the household who may or may not be able to describe the situation accurately. Census enumerators themselves often lack the technical knowledge necessary to discriminate between certain closely related occupations. Data of different census years must be compared with care due to the changing practices of the Bureau of the Census.

The Labor Force

A new concept of the working population—the labor force—was introduced in the 1940 Census (4, 5, 6, 7, 9, 10, 13, 16). In previous censuses “gainful workers” were reported as having gainful occupation regardless of their activity at the time of the census, but in 1940 the concept of “gainful workers” was replaced by the “experienced labor force” and reported on the basis of personal activity during the week of March 24-30, 1940. The total labor force, 1940, included men and women workers who were: (a) at work during the week of March 24-30, 1940; (b) with a job but temporarily absent; (c) on public emergency work such as WPA, CCC, and NYA but not employed; and (d) those not employed but seeking work, including experienced workers and new workers with less than one month's full-time experience. The “experienced labor force” included all men and women except new workers seeking work. Classes of persons such as retired workers and seasonal workers neither working nor seeking work at the time of the census were frequently included among gainful workers in 1930, but in general were excluded in the 1940 labor force. In censuses before 1940 some actual gainful workers were omitted because neither occupation nor industry was reported. For comparability, therefore, past censuses must be reduced slightly and the labor force of 1940 raised slightly (4).

The total labor force, 1940, comprised 52,789,499 men and women workers including 767,341 new workers. By subtraction the total “experienced labor force” numbered 52,022,158. It should be noted, however,

that occupational distribution before final enumeration was available was based on the figure 52,020,023 which was derived from a 5 percent sample.

Sampling Technics

Unique in the history of the population census are the sampling technics used for the first time in the 1940 Census. Based on tabulations of a 5 percent sample of the population returns multiplied uniformly by twenty, data were presented on the personal and economic characteristics of men and women in each occupation at the time of the 1940 Census.

Exact agreement is not to be expected between sample tabulations and tabulations of the complete returns, but an analysis of the statistics based on tabulation of the 5 percent sample of the population for items that were obtained also for the total population indicates that in 95 percent of the cases the sample statistics differ from the complete census statistics by less than 5 percent for all numbers of 10,000 or more; by less than 10 percent for numbers between 5000 and 10,000; and by less than 20 percent for numbers between 2000 and 5000. Somewhat larger variations may be expected in numbers below 2000. Even for these small numbers, however, the majority of the differences between the samples and complete statistics are less than 10 percent, altho much larger differences occasionally occur (16, Nos. 4 and 5). Sampling permits the collection of data on a large number of inquiries, the early release of preliminary statistics, the tabulation of a great many social and economic characteristics, and supplements the final figures (13, Part 1).

Population

For comparison of various occupational fields on a percentage basis, it is necessary to be acquainted with the data on total population. The total population of the United States in 1940 was 131,669,275 persons of all ages—66,061,592 men and 65,607,683 women—representing a 7.2 percent gain over 1930 (11, 12).

Number of Workers

The total number of individuals in the experienced labor force, 1940, included 39,944,240 men and 12,845,259 women, or a total of 52,789,499 workers, including those employed at the time of the census, those on public emergency work, and those seeking work, either experienced or new workers. This represents 52.2 percent of all persons fourteen years of age or over, or 79 percent of the men and 25.4 percent of the women (13). More than half of these workers were engaged in four major occupational fields: operatives and kindred workers, 9,476,597; clerical, sales, and kindred workers, 8,270,270; craftsmen, foremen, and kindred workers, 5,952,482; and farmers and farm managers 5,302,774. More men were employed as operatives and kindred workers, 7,125,098, than as workers in any other

major field; and similarly, more women were in clerical and sales fields, 3,478,682. On the other hand, there were fewer men in domestic service work, 161,411; and fewer women in protective service, 4721; and fewer women in semiprofessions, 106,411, than in any other major occupational groups. In the professional field there were nearly as many women, 1,439,174, as men, 1,609,298, in spite of the fact that in the experienced labor force men outnumbered women three to one; this is partially accounted for by the large numbers of women who are teachers and nurses.

In 1930 the "gainful workers" numbered 48,594,592—37,915,544 men and 10,679,048 women—or 54.5 percent of all persons fourteen years of age and over (84.1 percent of the men and 24.3 percent of the women). But these figures are not comparable with those in 1940 without being adjusted. The adjusted figures appear as follows:

	<i>Number</i>		<i>Percent</i>		
	1930	1940	1930	1940	Gain or loss
Men	37,008,000	40,284,000	82.1	79.7	-2.4
Women	10,396,000	13,015,000	23.6	25.7	+2.1
Total	47,404,000	53,299,000	53.2	52.7	-0.5

These percentages, admittedly only approximately accurate, support the general conclusion that during the decade 1930-40 there was a small decrease, -0.5, in the percent of the total; a considerable decrease, -2.4, in the percent of men; and a considerable increase, +2.1, in the percent of women fourteen years old and over in the nation's labor force.

Distribution of Workers

The occupational classification adopted for the 1940 Census differs considerably from earlier census classifications, not only with respect to arrangement, but also as to content of occupational titles. Differences are also caused by changes in the work content of occupations, occupational termi-

<i>Major occupation group</i>	<i>Percent of employed workers</i>	
	Men	Women
Professional and semiprofessional workers	5.5	13.2
Clerical, sales, and kindred workers	12.8	28.3
Proprietors, managers, and officials (except farm)	9.8	3.8
Craftsmen, foremen, and kindred workers	14.5	1.0
Operatives and kindred workers	18.2	18.4
Domestic service workers	0.4	17.7
Protective service workers	2.0	
Service workers, except domestic and protective	4.5	11.3
Laborers, except farm	8.7	0.9
Farmers and farm managers	14.7	1.3
Farm laborers and foremen	8.2	2.9
Occupation not reported	0.7	1.2
Totals	100	100

(Base 34,027,905 men and 11,138,178 women)

nology, the census schedule, instructions to enumerators, and methods of presentation. The 451 occupations of the 1940 classification are arranged into eleven major occupation groups with a twelfth group for "occupation not reported." The table shown reveals the major occupation groups and the distribution of employed workers by sex in the various fields of work (13, 14).

Census Results

Some of the results of the 1940 Census point out that the decline in employment opportunities that characterized the decade 1930-40 affected the employment of young workers particularly. Large numbers of young people classified as "new workers" in 1940 would normally have been at work and classified as employed workers except for the lack of jobs. Reduced employment opportunities also affected the number of elderly men available for employment. The proportion of women in the labor force was affected by adverse economic conditions, and probably some were forced to look for jobs in order to supplement the family income. The proportion of youth entering the labor force decreased also due to increased legal restrictions with regard to their pursuing certain occupations. Between 1930 and 1940 the minimum age for employment, at least in manufacturing, was raised to sixteen in ten states and the same standard was set by the federal government in the child labor provisions of the Fair Labor Standards Act of 1938. There was also an increase in the extent to which children voluntarily continued in school after reaching the age of fourteen; and in some areas, school attendance requirements were increased.

Occupational trends may be traced from 1870 thru the 1940 Census, but predictions into the future concerning probable supply and demand of workers in certain occupations, employment difficulties in particular occupations, employment security, and wages remain for individuals to estimate (4, 9, 13).

Localized Information

In counseling situations information concerning communities is of more importance than national totals because most individuals tend to remain in the states which they call "home." An indication of the mobility of the American people is given by the fact that even in the prewar years 1935-40, 86.9 percent were nonmigrants living in the same county (or quasi county) in 1940 as in 1935 (8). Since census materials furnish information for regions, states, and large cities, the character of industries and occupations that predominate relatively small areas may be determined. For instance (13) in Maine, of the 204,215 men employed in that state, 22,215 are farmers or farm managers; 8710 in retail trade; 8592 chauffeurs, truck drivers, and delivery men; 5453 mechanics, repairmen, and loom fixers; 5181 lumbermen, raftmen, and woodchoppers; 4434 carpenters; 2817 fishermen; and of the operatives: 7660 are in footwear industries; 6064 in

paper manufacturing, paper products, and printing; 3755 are in woolen and worsted manufacture; and 3372 in cotton manufacture. Other occupations in Maine employ fewer workers. Similar census details are available for large cities as well as states, and the War Manpower Commission has contributed to local labor market information.

In July 1944 the War Manpower Commission began issuing an industry area series (37) presenting in summary form basic descriptive and labor market information pertaining to a number of major industries in local areas. Designed to assist counselors in the U. S. Employment Service, the series has informational value not only to local office representatives who visit army and navy hospitals in their discussions with veterans who are scheduled for discharge, but also for schools and counseling agencies. Background rather than current labor market information is emphasized and descriptions cover the nature and location of an industry, occupational structure, wages, hours, union affiliations, working conditions, and current and postwar employment prospects of the industry. The statements include: bituminous coal mining, construction, cotton textiles, plastic materials, basic iron and steel, railroads, air transportation, merchant marine, slaughtering and meat packing, and trucking.

Area statements (33), first issued by the War Manpower Commission in July 1944, summarize labor market information pertaining to the principal employment centers of the country. These researches are designed to serve only as a broad guide to the employment opportunities in which non-resident veterans and war workers might display an interest and are intended for the use of personnel in local offices of the U. S. Employment Service in their counseling and placement activities. The statements indicate the nature of the local industries, the number of jobs expected to develop, the occupations in which openings are immediately available, entry wages, scheduled hours of work, and names of major firms in the area. For example, in the Birmingham, Alabama, area, major industries are named, good prospects are reported in major war industries, and between September 1944 and March 1945 it is predicted that workers will be needed in such industries as bituminous coal mining, 1900 workers, and iron-ore mining, 1200 workers; jobs are immediately available for aircraft workers, coal miners, and machinists.

To aid the counselor further in finding out about local opportunities, Zapoleon (32) carried out an intensive study of community surveys made during 1930-40 in ninety-six areas. The purposes of such surveys are (a) to supply vocational information and guidance to individuals, and (b) for use in planning or revising the curriculum which prepares them to take their place in the community as workers. Technics for future surveys were presented based on the experience of those who have conducted such surveys, and detailed information given is helpful in developing plans, carrying them thru to completion, and utilizing the findings.

Job Families

Considerable attention has been given to occupations which are in some way related. The Division of Occupational Analysis and Manning Tables of the War Manpower Commission studied jobs which were related to one another in some way and developed two series of job families—one for occupations and one for industry.

The "O" series on occupations (38) begins with precision lens grinder. Following a description of his duties are lists of occupations which require knowledge and abilities similar to his and yet meet the requirements of precision lens grinder in varying degrees and varying combinations, as for example: testing and measuring glass by various optical methods; precision grinding and polishing of materials other than glass; hand-tool grinding and polishing; and cutting or drilling glass.

The "I" or Industry Series (36) consisting of forty-five studies resulted from basic materials including job analysis schedules made during the course of careful and detailed field observation of each occupation. Evaluations and significant job and worker requirements were noted, the findings were used in selecting from a wide variety of other industries, and occupations listed which had similar requirements. The job family provides information useful in placing workers disemployed from their usual occupations, in recruiting workers with related experience in other industries, and in upgrading and transferring workers within industry.

Specific Occupations

A number of researches on specific occupations of value to counselors and educators were released by government agencies:

Ceramic technology and engineering—The National Roster of Scientific and Specialized Personnel revealed that ceramic products are manufactured by any one of five general processes of hardening after the product has been molded, and ceramic engineers specialize in any one or more of several well-defined areas: research and development; teaching at the university level; plant control; management and administration; production; sales and service; and design (35).

Agricultural engineering—The Roster also in its study of agricultural engineering (34) found that such engineers may specialize in five major divisions: rural electrification; agricultural machines and power; farm structures and utilities; processing of farm products; and soil and water conservation. Related fields include mechanical, electrical, and civil engineering; manufacture and processing of dairy products; animal products technology; industrial bacteriology, and dairy bacteriology.

Private duty nursing—Denison (20) found that the number of registered nurses engaged in private duty work had declined drastically in the decade of the thirties until by 1941 there were approximately 62,000. In that year the median gross cash full-time income was \$1168, and in addition these nurses received an average of 235 meals during the year.

Medical service—Denison (21) also found that the average net income of physicians was \$5179. The median net income was \$3912 varying as follows: nonsalaried physicians \$3756; part-salaried \$4538; and all-salaried \$4300. The median income of physicians was the highest in the District of Columbia.

Dentistry—Dentists constitute the third largest group of independent professional practitioners in the United States, and the number of active dentists has remained constant at approximately 70,000 during the past fifteen years (22). Their average net income was \$3773 in 1941, the largest incomes being earned by those thirty-five to forty-four years of age in cities of 25,000 and over.

Legal service—There was a large increase in the number of lawyers from 1929 to 1941. In 1941 the average income was \$7172 (gross) and \$4794 (net) well below the 1929-31 levels but above those of intervening years. Highest incomes were reported by lawyers in the Far West (19).

Chemists—More than forty government agencies employ chemists and in all some 3000 chemists and 670 chemical engineers are employed, nearly half of whom are located in or near Washington (26).

Teaching—Teaching, the largest of the professions, employed 300,905 men and 801,078 women in 1939-40. At the beginning of the school term 1943-44, more than 7500 classrooms were vacant because teachers could not be found. Average annual salaries of the 1940-41 public-school instructional staff varied from \$568 to \$2591 (28). The need for teachers is shown by the fact that during the year 1942-43, 192,500 teachers left their occupations because of the demands arising from the war emergency (29), and since 1941-42 there were 15,100 teaching positions that were abandoned completely by 1943-44.

Agriculture—From the wealth of statistical information on agriculture, (1, Table 35) a counselor may visualize the different types of farms according to the average value of farm products per farm: farms with principal source of income from livestock \$788; dairy produce \$787; hay and grain \$760; cotton \$450; tobacco \$615; sugar \$2758; rice \$1149; vegetables \$665; fruits \$915; flowers and plants \$2991; and nursery products \$4971.

Back to Civilian Life

Prepared to aid enlisted men in the Army and Navy to return to civilian jobs after being discharged are two studies by the Bureau of Manpower Utilization of the War Manpower Commission. For those in the Army a series of job families was made up, each of which lists civilian jobs related to a military occupational specialty (39), to indicate how military experience and training may be utilized in a return to civilian life. Since many army occupations have no exact counterpart in civilian life, the aids were designed primarily to suggest placement opportunities in civilian life for discharged enlisted personnel who have no significant civilian experience or training upon which decisions can be based. The same technic

is used for all occupations: the army designation is found in the index and a brief account of the duties and experience described. Four columns of data follow: (a) related civilian occupations which have duties similar to the army duties; (b) additional training required to qualify for the civilian job; (c) physical activities; and (d) working conditions.

For navy men returning to civilian life opportunities are listed separately (40) under eighty-eight special aids with descriptions of the qualifications possessed by a man having a specific navy rating and classification, expressed in terms of the work duties performed and the knowledge, skill, and ability necessary to carry out these duties.

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34. *Handbook of Descriptions of Specialized Fields in Agricultural Engineering.* Prepared by the National Roster of Scientific and Specialized Personnel, Bureau of Placement, War Manpower Commission. September 1944. 7 p. (Mimeo.)
35. *Handbook of Descriptions of Specialized Fields in Ceramic Technology and Engineering.* Prepared by the National Roster of Scientific and Specialized Personnel, Bureau of Placement, War Manpower Commission. September 1944. 16 p. (Mimeo.)
36. Industrial ("I") Series (Job Family Series). Concerning occupations in forty-five fields. The following are illustrative: Airframe Industry. No. I-40. April 1943. 127 p. 35 cents; Airframe Industry. No. I-65. June 1944, Aluminum Production. No. I-50. August 1943. 52 p. 15 cents; Aluminum Production. No. I-58. September 1943. 33 p. 10 cents; Ammunition Manufacturing. No. I-51. September 1943. 71 p. 15 cents.
37. Industry Series. *Labor Market Information for United States Employment Service Counseling.* Reports and Analysis Service. A series. The following are illustrative: No. 12-1 Bituminous Coal Mining. 1944. 4 p.; No. 15-1 Construction. 1944. 4 p.; No. 22-1 Cotton Textiles. 1944. 5 p.
38. Occupational ("O") Series: (Job Family Series). The following are illustrative: Aircraft Mechanic, occupations related to: No. 0-89. January 1944; Airplane Woodworker, occupations related to: No. 0-32. May 1943. 8 p. 5 cents; Boilermaker, occupations related to: No. 0-12. April 1943. 10 p. 10 cents; Clock and Watch Repairman, occupations related to: No. 0-88. January 1944.
39. *Special Aids for Placing Military Personnel in Civilian Jobs* (Enlisted Army Personnel.) March 1944. 490 p. \$1.
40. *Special Aids for Placing Navy Personnel in Civilian Jobs.* May 1943. 112 p. 30 cents.

CHAPTER VIII

Preparation of Personnel Workers

ARTHUR J. JONES

THE greatly increased interest in personnel work during the past two years, the result of the exigences of war, has been noted in previous chapters. The needs of war workers, of young people about to be inducted into the armed forces, as well as of those about to be discharged, have been the subject of almost feverish activity. These more or less specialized needs, together with the great number of persons involved, have called for the training of thousands of personnel workers and the retraining of those now in service.

While activity in the training of personnel workers has been marked, there has been comparatively little actual research done. The desperate need for trained, competent workers has made almost impossible any controlled experimentation or extensive research. The diversity of the plans now in operation, hastily set up as many of them are, should offer rich ground for analysis and evaluation after hostilities have ceased.

Types of Research

Research in the preparation of personnel workers may be roughly classified under the following types which might better be called methods of approach to the problem:

1. The attempt to find what personnel workers do; what their duties and responsibilities are. These attempts have taken the form of job analyses from observation and from the statements of personnel workers themselves.
2. The discovery of the patterns of knowledges, skills, attitudes, interests, and characteristics necessary for the successful performance of the duties and responsibilities. The approach to this problem has been thru an assembly of the opinions of those considered to be experts in the field or by securing the opinions and judgments of the personnel workers regarding what they found helpful and in what they felt they were weak.
3. The determination of types of courses, training, and experiences that are most effective in developing the patterns of abilities necessary for success on the job. Research efforts along this line have been very sketchy. Practically no controlled experimentation has been undertaken that might reveal certain types of preparation that have proved to be better than others.

Personnel Workers in Educational Institutions

There has been little research work during this period in connection with the training of personnel workers for colleges and schools. Two only will be mentioned. The Committee on Student Personnel Work of the American Council on Education (10) assembled a brief list of duties of personnel

workers and suggested certain courses that should be organized for the training of counselors whose chief duty would be the guidance of returned veterans.

The study of one hundred selected secondary-school counselors by Cox reported in Vol. XII, No. 1 (February, 1942) of the REVIEW has since been completed and is now in the process of publication. This study is not merely a job analysis; it is a careful case study of one hundred selected counselors. It includes a study of their duties and responsibilities and what the counselors themselves think about these duties; whether, in their opinion, the work assigned helps or interferes with what they consider to be their real job. It examines their training and experience and describes their attitude toward this training, whether they think it contributed or did not contribute to their success. It also describes the characteristics of these counselors as revealed by personal conferences and by their own statements. The personal characteristics were obtained by means of questionnaires and personal and group conferences with counselors. They were often revealed incidentally. They included the opinions of the counselors themselves regarding their own points of strength and weakness. Four characteristics not usually listed are: (a) interest in people; (b) understanding of people different from oneself; (c) awareness of one's own limitations; and (d) a sense of mission. The profiles and patterns of characteristics varied and no pattern could be found that was definitely indicative of the successful counselor.

The preparation of these counselors was extensive. Almost all had graduate work equal or nearly equal to a master's degree; five had doctor's degrees. Practically all had courses in education, guidance and personnel work, psychology, measurements, and socio-economics. Few had courses in social case work, psychiatry, or mental hygiene. Needs felt were for more and more effective courses in personality problems, tests and measurements, placement, psychobiological factors in adjustment and development, counseling technics, and organization and administration of guidance.

The experience of the counselors varied greatly. No clear pattern could be discerned that might be of significance. The most significant point was that these counselors seemed to have an unusual ability to get from any type of experience something of value to them in their work.

Preparation of Personnel Workers for Industry

This period has produced very little research concerning the activities of personnel workers in industry. It has, however, emphasized the need for a recognition of two somewhat distinct jobs in this type of personnel work: one dealing with administrative problems; the other with the psychological problems of the employee. The types of duties and functions of the personnel worker were found by Cantor and Bonning (2:108) to be: "transfers, gas and tire rationing, absentee control, induction of new employees,

bond and insurance service, credit union, housing and transportation problems, care of children of women at work." These, while necessary, are considered to be administrative duties rather than employee counseling. His real function in industry was stated as follows: "He contributes to better productive effort by helping the employee get rid of disturbed feelings and hence making him more content on and with his job." The activities and duties of the employee counselor were listed by Kushnick (4:1) as follows: "assists the employee in orienting himself to his work and to his associates; assists the employee in making satisfactory living and social arrangements; observes attitudes and reactions of the employee which prevent him from doing his best work, and helps him to develop better conduct and attitudes on the job; identifies problems of individual employees that need special attention and makes referral to proper agencies; discovers conditions within the work situation that may prevent the employee from giving his best performance, and recommends remedies; aids supervisors in establishing harmonious cooperative and understanding relationships with employees; assists in interpreting management policies and practices to employees and in turn apprises managing officials of the reactions of employees to these policies and practices."

Baker (1:357) made an analysis of sixty counseling programs and listed the qualifications found in these programs. Warner and Prouty (9:144) found the desirable qualifications of the executive personnel officer to be: "He should be, or have been, a successful executive familiar with the problems and requirements of getting things done through personal leadership of people. He should have a well integrated personality, free from personal frustrations and idiosyncracies of thought and action. He should be readily approachable, friendly, sympathetic, and able to be objective with people's problems. He must be able to remain emotionally aloof without being emotionally frigid, and above all, he must have no personal ax to grind."

Drake (3:651) concluded that training should be on the graduate level and should include the following areas: "Psychology (educational, social, abnormal, industrial), sociology, industrial history, labor economics, statistics, industrial organization and management, labor legislation, law, industrial engineering, industrial medicine, and personnel administration and industrial relations."

McCord and Planty (5:326, 332) found by actual trial that "the teaching profession can supply industry with recruits who may be transformed into highly skilled personnel workers after a minimum of training and orientation. . . . Wartime experience has shown that it is generally easier for an intelligent person who has some knowledge of the science of human behavior to pick up whatever he needs to know of production techniques than for a successful production worker to orient himself in the field of human relations."

Personnel Workers in Government Agencies

The Bureau of Training of the War Manpower Commission has assembled material that has great significance for the training of personnel workers. *The Training of Vocational Counselors* was prepared to help meet the needs of the returning veteran for counseling and is intended to be of use to governmental agencies, to industry, and to colleges and universities in organizing training programs. It includes suggestions for extended training of full-time personnel workers and for short courses to help volunteer community workers.

The procedure in the organization of this material for the War Manpower Commission (8:8) was: (a) to secure from the Occupational Analysis Division of the War Manpower Commission the list of duties of personnel workers; (b) to infer from these duties the understandings, abilities, and skills required to perform these duties; (c) to formulate an outline of fields or subjects in which training should be given; (d) to prepare topical outlines of the essential content of each field or subject; (e) to secure criticisms of these outlines from approximately one hundred competent people; (f) to revise the outlines in light of the suggestions given.

The duties of the counselor listed (8:5,6) cover a family of counseling positions and include the following: "obtains and collects information about the individual; obtains occupational, educational, and other information; weighs and interprets all secured information and evaluates the individual's potentialities in terms of probable educational and occupational adjustment; assists the counselee in making and carrying out educational and occupational plans; follows progress of counselee during training program and subsequent placement and assists him in meeting adjustment problems." Basic qualifications are given in detail (8:6,7) and outlines for extended training and for short courses are given.

The general headings of the topics suggested for the extended training course are as follows (8:10-39): an introduction to vocational counseling; personality adjustments; measurement for vocational counselors; rehabilitation of the handicapped; educational and occupational training opportunities; occupational information; labor market analysis in vocational counseling; labor problems; personnel administration in business and industry; community organizations and vocational counseling; public personnel administration; technics of vocational counseling; supervised counseling practice (internship).

Personnel Workers in the United States Navy

The most notable research work of the Navy in personnel training during recent years has been the collection of material for the training of specialists (C)—classification interviewers. The *Manual of Procedures* of the Navy Department (6: IV, 31) does not clearly separate the duties of the classification interviewers or the basic skills and information needed

from the outline of subjects of instruction. The outline of these subjects (6:7, 8) is as follows: (a) organization of the naval training station; (b) organization, procedures, and functions of the selective department; (c) selection department records; (d) interviewing; (e) occupations; (f) naval service schools; (g) naval rates; (h) psychology of vocational adjustment, personnel work, morale, job satisfaction, mental hygiene; (i) testing principles of mental measurement. There is no clear statement of special qualifications for the position.

Personnel Workers in the United States Army, Separation Classification Section

The training program set up by the Separation Classification Section for officer's classification section personnel was the result of extensive study of the needs of discharged men and of types of training programs in other agencies. While no separate statement of duties is given, the general purpose or "mission" is stated by Oberman (7:1) as follows: "To train and prepare selected officer personnel in the principles and techniques of separation classification, interviewing and counseling with a view to their assignment as educational and vocational counselors in hospitals and separation centers."¹

The training covers a period of 240 hours and is outlined under the headings: (a) subject; (b) scope (purpose); (c) text reference and hours.

The qualifications for this type of personnel worker are stated under the heads: (a) personal qualifications; (b) civilian and military occupational qualifications; and (c) educational qualifications.

The subjects, the scope or purposes of which is given in great detail, are: (a) separation center procedures; (b) interviewing; (c) counseling; (d) group guidance; (e) separation classification testing; (f) separation classification library; (g) case histories; (h) national aid and state aid for veterans; (i) methods of training; (j) special regulations affecting veterans; (k) miscellaneous subjects.

Trends in Personnel Training

If one may judge from the studies reviewed, the trend in the selection and training of personnel workers is definitely in the following directions: (a) more careful initial selection of those who apply for training; (b) increased emphasis upon personal characteristics that are related to contact with people, understanding others, ability to get along with people who are different from one's self; (c) emphasis upon sympathetic but objective attitude; (d) recognition of personnel work as a profession; (e) necessity for extended training on the graduate level; (f) importance of wide and extended experience in many situations.

¹ There is a similar program, with slight changes, for enlisted personnel. The entire program is now being revised.

Needed Research

The studies reported reveal the need for further research in the following areas:

1. The functions, duties, and activities of successful personnel workers in order to discover (a) what functions, duties, and activities are really essential and which ones interfere with the proper functioning of counseling and (b) how counselors make use of the duties and responsibilities thrust upon them in improving their work as counselors.
2. The methods and devices that are found most effective in the initial selection of those who present themselves for training.
3. The methods used for improving the personal characteristics of those in training.
4. The types of training, including subjects and content of subjects, and supervised and unsupervised experiences that are found by experimentation to be most helpful. Drake (3:651) states this as follows: "The great need, at present, is for cooperative research to determine the essential content of subject matter considered essential in the vocational preparation of personnel administrators so that this may be reduced to some organized curriculum."

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INTRODUCTION

THIS is the fifth issue of the REVIEW OF EDUCATIONAL RESEARCH dealing with "General Aspects of Instruction: Learning, Teaching, and the Curriculum." It reviews the studies published in these areas for the three-year period ending December 1944. Several changes have been made in organization of the content since the first issue was published in 1933. The first three cycles of the REVIEW included a chapter on supervision, a subject which is now treated under "Organization and Administration of Education." In this issue, as in the previous one, are studies in the fields of philosophy, radio and visual education, and school libraries.

Altho there is no dearth in the number of articles published, there were fewer studies in some areas during the last three years than in the preceding three-year period. This is to be expected, since many young men and women who normally carry on research are with the armed forces in other than educational activities. Furthermore, the effects of the war on education are reflected in the studies reviewed. Studies carried on in military camps reveal the effects of controlled environment and the value of large numbers of cases. In spite of the influence of the war, the authors of the various chapters have tried to review all those studies that make a contribution to education whether they were made in a military camp, in a scientific laboratory, in a classroom, or in a library.

From the published articles in these areas two generalizations may be made. First, many of the studies have been conducted under the auspices of educational foundations and cooperating agencies and, second, the research technics used in evaluation have become less statistical, but no less valid, than those formerly used.

MANLEY E. IRWIN, *Chairman*
Committee on General Aspects of Education

CHAPTER I

Philosophy of Education

HAROLD SODERQUIST

Philosophy as Research

WHETHER philosophy may be rated as research has been much debated. The reviewer proceeds on the premise that making observations and thinking about their significance are two inseparable aspects of any research which is not headed for futility, but that specialization is permitted here as in other occupational areas. In other words, the scientist, who has little time or inclination for speculation about his findings except within his own restricted field, and the philosopher, who is fully occupied in trying to find some common meaning in the multitude of data furnished by science and by common observation, are both considered as engaged in research provided that there is evidence that both are honestly and obstinately concerned with truth.

Doubtless, in view of the all-inclusiveness of his field and the number of possible frames of outlook into which he might fit the multitude of jigsaw bits of experience, the philosopher will be tempted to choose that frame which is most congenial to his own temperament and will-to-believe. Nevertheless, the reviewer is still inclined to rate the philosopher's efforts as research, provided that the faults of irrelevance to living problems, self-contradiction, disregard for recalcitrant data, and unworkability in the practical situation are not too immediately evident in his structure.

Certainly there has been no smaller volume of contributions to the field of educational theorizing during the past three years than during any previous period of equal length. Does any of it measure up to the standards of research as defined?

. Most of the contributions herein mentioned, only samples because of lack of space, are of the briefer critical type, and are efforts largely by younger thinkers in the field. Because of their pertinence to the problems which beset education these contributions are cited as philosophic research.

Philosophy and Education

It seems fitting to open this REVIEW by calling attention to the increasing recognition accorded philosophy and general theory in education. While for a number of years educational research of the scientific experimental type threatened to replace philosophy in our teacher education curriculums, the trend today is toward a restoration of the latter. Any clash between philosophy and science in education is, as Champlin (11) sees it, "unworthy controversy."

The trend in defense of educational philosophy is well represented by replies to Valentine (49) who in 1940 severely criticized that subject as devoted to finespun metaphysical theorizing for which students were ill

prepared and had no need. Thompson (47) immediately countered that it is necessary for the professional educator to know "the differences which varying basic philosophical assumptions will lead to." While Hatch and Hatch (23) reported a study showing how educators and their philosophies follow rather than lead social and political change, Browning (8) and Wahlquist (52) insisted that teachers need philosophy if they expect to be professional people and not mere technicians. Wise (54) demonstrated the need of philosophy in examining the assumptions of all sciences and arts (including education and educational research) to save time in useless experimentation.

A most significant recent event demonstrating the increasing importance accorded to philosophy in education is represented by the action taken by the Committee on the Teaching of Philosophy, Eastern Division of the American Philosophical Association. This report, prepared by Balz and Larrabee (3) proposed that the widening gap between educators and professional philosophers be closed and that since each field must be a practical concern of the other (as apparently only James and Dewey seriously recognized) the two professions henceforth work together. In a later appeal (32) the same authors urged "union now" on the premise that only one acquainted with both philosophy and education is fit to teach.

The Continuing Battle of the Systems

The day of comprehensive doctrinaire formulations seems to be over. The most recent of these, Frederick S. Breed's *Education and the New Realism* (1939), is mentioned here because it was the first systematic attempt to deduce an educational philosophy from realism. Tonne's more recent contribution (48), while entitled "realistic philosophy," is founded not so much on a conscious metaphysics as it is an appeal to common sense, based on the hard realism of the demands of practical schooling which has found pragmatism unworkable. Defenses of the other systems are elaborations of previous basic statements, represented in this review by Maritain (37, 38) and McGucken (36) for the Catholic neo-Thomists, by Kilpatrick (31) and Childs (12, 13) for the experimentalists, and by Horne (25) for the idealists.

If the number and volume of published statements by partisans of systems may be taken as a guide, there has been a growing reaction during the last three years against pragmatism and against the experimentalism of the "progressives" who take their cue from it. The critic of progressivism best known to teachers in the elementary- and high-school field is William C. Bagley. While Bagley himself is considered an "essentialist" in education, he is willing to accept whatever good there may be in what he calls the "fair weather" philosophy of progressivism, which has seemed to him (2) and to Shaw (45) to be willing to "throw out the baby with the bath" in its recent "scurry for cover" (referring to the recent change in name by the Progressive Education Association).

Perhaps the most notable attack on pragmatism is that made by Kandel (30) a distinguished educator who has had close contact with protagonists of this way of thinking. Kandel dubbed the pragmatic tendencies of our times as anti-intellectualistic and a "retreat from reason," the same brand of thought which activated Hitler and the Nazis.

Professors at War

But for the most resounding clash between the traditional antagonists one must go to the field of higher education. The controversy is mainly between those who might be classified as "idealists" in their educational thinking and those who are "experimentally" minded. Because of their aversion to the latter, a few of the "realists" have also entered the dispute, and with some reservations have sided with the idealists. Neither side is satisfied with the showing of higher education today. Both feel that it is without rudder or goal. Each side charges the other with failure to prepare youth for the intellectual and moral demands of democracy and of a world in need of moral revival.

What is heartening for education is that both sides profess to welcome the showdown which may result in something positive for the guidance of the distraught educational profession. The great antagonists are still Robert M. Hutchins and John Dewey, each with followers more belligerent than himself.

The present phase of the controversy has been precipitated by the wartime contact between the colleges and the military forces, altho the beginnings of the struggle had occurred long before. The highly vocational and professional demands of the military, and the subordination of the humanities to the mechanical and scientific subjects have alarmed those who see the present chaos in the modern world as due to failure in social and moral thinking. The remedy proposed by Hutchins is to make the humanistic classics of history, the "great books," the required core of the college curriculum and to keep vocational and professional training out until a basic general education has been acquired. This has been done more completely at St. Johns College than elsewhere. Eloquent arguments in the name of freedom and morality have been made by Hutchins himself (26, 27). Even more outspoken and aggressive are Adler (1), Barr (4), and Buchanan (9) who have gone all out both thru press and platform to force the battle. Van Doren's apology (50) for the liberal arts, itself rated by many as a literary classic, was prepared at the request of the Association of American Colleges.

The opposing side has countered with equal "either-or" vehemence. Dewey (16) welcomed the fray as a "drawing of lines" which "will not only serve to clear up confusion in our educational estate but will tend to breathe life into the dead bones of philosophy." He admitted that there was some excuse for the medieval clerical educators in reviving the Greek classics, but observed that to go back to the old books is simply anachronistic. Bode (6) averred that there can be no compromise between

going back to the closed system of the eternal verities and going forward experimentally in the "wide-open universe" of James and Dewey. The methods of science must apply to social and moral problems as well as to the mechanical and technical. Hook (24) denounced any revival of persecution of "heretic" professors by the methods of the medieval church, while Gideonse (21, 22) attacked Walter Lippmann's demand (35) for moral education thru "restoration" of the old disciplines, proposing instead a new structure based upon the needs of the times.

In the meantime our analysts on the side lines see a deep significance in the controversy. Lindeman (34) prophetically announced that "the people of the United States, whether they know it or not, are moving irrevocably toward the most profound debate since the issue of slavery divided the nation." Dighton (17, 18) found in the "war of the professors" a reflection of deep-growing conflict of beliefs and aims in our political and social life. While both sides agreed that education is in sad need of reform, and both invoked "freedom," "democracy," and "liberal education," there was little agreement between them on the details of achieving these professed aims. Dighton saw totalitarianism and absolutism as characterizing the thinking of both camps, and their subordination of education to political ends, even tho in both cases it is done in the name of democracy, as making propaganda of education. Finally, he forecast that while social and economic change brought on by the war will itself settle the issue, leaving no one fully satisfied, the hopeful result of the "academic self-analysis" will be a greater awareness on the part of more people of our real educational problems.

Criticizing Dighton for deploring the enlistment of education for the ends of politics, Brameld (7), who championed social functionalism in education in his turn, lamented the present reactionary trend. The retreat of the militant Progressive Education Association to its new and safer name American Education Fellowship, the rise of the Essentialist Committee for the Advancement of Education, and the demise of the progressive journal *Frontiers of Democracy* are ominous signs of the counter-revolution. The success of the revolt he charged in part to Hearst, to the extremists among the progressives themselves, and to inadequate financial resources for making progressive methods functional in those schools which have favored them. However, he did admit, wistfully, that the growing public enmity to modernism may be a part of the general disillusionment arising from the failure of liberalism to solve our social and moral problems.

Theology and Education

General disillusionment has made certain groups among our educators bold not only to demand a return to the timeless and traditional in the liberal arts but also to the verities of religion. Most active have been the Catholic protagonists of neo-Thomism, best represented by scholarly Maritain (37, 38). To counter possible alarm at the thought of returning

to medieval verbalism in educational method, special efforts have been made to demonstrate that self-activity by students is also demanded by modern scholastics (for example, Johnson (29) and Sanders (44)). Analysis makes it evident, however, that by "activity" is meant active thought in following the instruction rather than the wide-open experimentalism sponsored by the pragmatist-naturalists. The latter are still looked upon as the great enemies of religion and morals.

Outside of Catholic circles there is a growing call, altho less outspoken, for religion as the nucleus of education. Nash (41) proposed that Christianity be made central in instruction. The Protestant fundamentalist view was represented by Cooke (15) who saw religion as the only answer to the contemporary quest for certainty. The Protestant journal, *Christian Century*, rejoiced at the installation of a federated theological faculty at the University of Chicago and at Hutchins' exaltation of theology to the pinnacle of the liberal arts temple (14).

The last yearbook of the John Dewey Society (28) showed that spiritual values are taught in the public schools without the introduction of dogma and that efforts in this direction can be improved.

Toward Eclecticism

Besides the trends of thought in education already described there remains what appears to the reviewer as the most significant of all, namely, the increasing demand for mediation between champions of clashing metaphysical views. Whether this call is due to "war fatigue" or to increasing philosophical insight is not clear. However, events have a habit of shaping thought. The Forty-First Yearbook, Part I, of the National Society for the Study of Education (42) which appeared in 1942 is notable in that it is a symposium of proponents of the four main viewpoints in education. While no special effort at conciliation is made, Chairman Brubacher expressed the hope that "if . . . this yearbook can aid ever so little in reducing conflicts, in promoting communication, and increasing cooperation, it will have been eminently worthwhile."

The authors of most of the textbooks that have been published in recent years have tried to present impartial expositions of each of the historical world outlooks and its implications for education, leaving the teacher to make his choice. Indeed, eclecticism has often been suggested as the preferable route, altho because this recourse has had such a bad reputation in philosophical circles, few educational philosophers have had the temerity to advocate it all out. However, Lawson (33) reassured that in spite of the general conception that eclecticism is cowardly, it really takes more courage to follow this route than to "run with the herd" by uncritically attaching oneself to some ism or cult. He warned, however, that true eclecticism is neither syncretism, nor expedient "middle of the road" thinking, and that it must not itself become a fetish. Like any other philosophy eclecticism must subject itself to the test of reason, experience, and science. Pulliam (43) pointed out that our enthusiasm of thirty years ago for education as

a pure science has dimmed, and that we have gained the insight that education is a practical art like medicine and engineering, applying the findings of many of the pure sciences. Cultism is no more applicable in education than in any other practical art. Champlin (10) concluded that the either-or logic in education is futile and leads toward confusion; that the both-and procedure is necessary for fusion. Weiss (53) made a case for both traditionalism and progressivism in education. Wahlquist (51) concluded that "the presumably illogical middle-of-the-road schoolman who has a real sense of values is freer than the one who attaches himself to one of the systems (including even experimentalism), which soon leads to an educational stereotype." Progressive-essentialism in education is advocated by Stanley (46) to avoid being caught on the horns of the false dilemmas of thought which grow out of the either-or reasoning of the partisans. Blau (5) felt that it is high time for educators, both progressives and fundamentalists, to agree on some cooperative philosophy to enable them to stand together in opposing forces which would hold the profession in a rut.

Illustrative of the conciliatory trend in educational thinking and in line with the semantic demand for reduction of intergroup misunderstanding arising from disagreement over the meaning of words, is a call for critical analysis of the language and detection of false dichotomies in the reasoning of our educational spokesmen. Typical of this trend is Foley's plea (20) for analysis of the meaning of generalities used by partisans in educational thought. In a later statement (19) he would have teachers declare their "educational independence" by critically examining the slogans by which would-be educational leaders have confused and tyrannized the profession for many years. Gideonse (21) declared that "a good deal of the argument" in education "is anchored in the special use of words—and tends to evaporate once terms are carefully defined and consistently used." Apparently the methods of Socrates are as much needed in our day as they were when he was the "gadfly of the state."

Meantime the cause of mediation is championed in distinguished manner by an outstanding liberal in social and educational thought. Meiklejohn (40) saw us now as suspended between the educational world of the medieval church and the present world of pragmatism, a world "powerless to be born." A new education must be sponsored by a truly reasoning state constituted on brotherhood, taking its "cue from Rousseau," and having a planned program for the training of men to use their natural powers of reason. At its highest level such a state would be a secular international order.

Meiklejohn's recent reply (39) to John Dewey (16) was an effort to mediate between the two camps in higher education, who, he insists, both work for the same ends tho their means may be different. As a part of his argument he defended the curriculum of St. Johns College, which, he pointed out, is as much devoted to the study of the sciences as it is to the great books.

Conclusion

The reviewer suggests that if the educator's thinking must be eclectic (this seems to be unavoidable if he is to find much practical use for philosophy), it would seem that a new type of metaphysic and a new logic are demanded. It is the reviewer's opinion that even pragmatism which appears most friendly to the idea of a plural approach to the solution of life's problems has become too absolutistic in its prescriptions for so large a part of life as education. John Dewey recently pleaded that the straight-line, "either-or" logic used by some of his followers in their controversial zeal is no more suitable to defend experimentalism than any other doctrine. The admission that dogmatism is indefensible even in combating dogmatism surely has interesting metaphysical implications. It seems to suggest that experience presents so ungeometrical a surface to efforts at map making that no single, systematic, tightly-reasoned world-formula has yet been found workable when taken seriously and pursued to its logical conclusions. This reasoning is supported by the common-sense intuition that "one should not go to extremes in applying any system of belief," worded in sophisticated manner by Samuel Butler: "Extremes are alone logical and they are always absurd, the mean is alone practicable and it is always illogical."

What has been said suggests that it would be safer for conscientious people to treat the great metaphysical formulations as works of art, each to be accepted as hinting at useful truth, but in no single case to be taken as schematic of all the facts of experience. Taken all together, and even so applied to life's problems with a certain amount of artistic looseness, they would no doubt shadow the truth more faithfully than if adopted singly as blueprints for action.

One other suggestion remains, namely, as Bertrand Russell has ventured, "that two rival hypotheses (may) be able to account for all the facts" (*Problems of Philosophy*). If this is true it is suggested that idealism and realism both be accepted as eyepieces of the cosmological telescope to be used alternately as human scientific and aesthetic needs demand; and that pragmatism be retained on "sanity patrol" to remind observers that the philosophic instrument is only an extension of *human* vision and must be used always for *human* purposes. The reader will understand that this also is spoken poetically.

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CHAPTER II

Curriculum

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WITHIN the three-year period 1942-44 there appears to be a smaller number of significant research studies on the general curriculum initiated than in any similar period for a decade. Some research previously begun has been carried thru to publication. Much of this has centered in secondary and higher education. Altho there have been only a few studies such as Felsted's (26), Leslie's (38), and Pounds' (53) which have dealt directly with the war situation, the impact of the war may explain the increased proportionate emphasis on the upper levels.

On the preschool and elementary-school level research is slanted more and more toward the genetic approach. There is still some investigation into the relative worth of the activity or informal procedures on the one hand and subjectmatter or formal methods on the other. Even this type of research is giving way to inquiries concerning how children of various ages and in differing circumstances grow and develop and what environment (curriculum) is best suited for them.

The curriculum research on secondary education continues to have large emphasis on such mechanics as curriculum constants and college requirements; but this emphasis is shifting toward a study of youth, their needs, and interests.

In the research in higher education there is an increasing tendency toward critical evaluation of the offerings in liberal arts colleges, teachers colleges, and professional schools. Indications point to much curriculum planning on the part of both secondary schools and colleges to accommodate the returning veteran.

Curriculum research on all levels is becoming less and less a matter of individual initiative and effort. Curriculum research is now being conceived more as a large cooperative activity frequently financed by foundations and carried out thru national or regional groups. Two rather important examples of such studies are Ivey's monograph (20) on channeling research for the Committee on Southern Regional Studies, and Vickery and Cole's publication (70) for the Bureau of Intercultural Education.

In connection with this chapter other surveys and critiques of curriculum research (11, 13) should be scrutinized.

Findings in Childhood Education

Quick's study (55) of the implications of the philosophy of experimentalism for some unsolved problems in the education of children growing toward six should be useful to those concerned with curriculum planning for nursery school, kindergarten, and the early months of first grade. Three large groups of problems and needs were found: (a) those inherited from the pattern of the traditional school and the neglect of five-year-olds;

(b) those problems that the war and the fast-moving pace of change have raised to the level of social concern; and (c) those problems that thoughtful people must face as they look toward the needs of young people in the postwar world. The study developed fourteen criteria from research literature and from tested experience as a basis for planning preschool education, for criticizing programs already in existence, or for meeting ongoing problems.

The Iowa Child Welfare Research Station, the Brush Foundation Studies of Child Growth and Development at Western Reserve, the work at Yale, and research in similar centers continue to accumulate essential findings regarding human growth and development and regarding how learning takes place. Jersild and Fehلمان (34) have reported on principles for curriculum making derived from such research, and Prescott, Redl, and others working at the Collaboration Center on Human Development and Education of the Commission on Teacher Education of the American Council on Education at the University of Chicago have undertaken a similar responsibility. Significant in this connection also is the report (2) of the American Association of Teachers Colleges which, tho primarily aimed at improving the education of prospective teachers, is important for curriculum workers at all levels in its statement of basic generalizations. Likewise important is the report (50) of the faculty of the University School at Ohio State University who have carried their analysis of child development study and its curriculum applications from ages three thru eighteen.

Several attempts have been made to determine the effectiveness of the "activity" idea in education in line with modern theories of child development. In the three-year period under consideration there appear to be at least three studies dealing with the informal curriculum at the level of childhood education. Black (7), in a historical treatment of the activity movement, investigated the evolution of the concept of activity in education from its beginnings in Europe to the present time in the United States, particularly as it pertains to education in the first six grades of the elementary school. The study points out the emergence of a number of practices which have been included under the name of activity program and attempts to evaluate these and determine what practice should be. The method used was that of a checklist questionnaire constructed from reading a large selected body of literature related to the activity program and having the items rated by a jury of experts. As compared with traditional schools, the suggested practices that have evolved indicate the advisability of providing many concrete experiences, more flexible schedules, more participation by teachers and pupils in selecting subjectmatter, and the socialization of classroom procedures. Spikes (64) made an evaluative appraisal of the curriculum programs in three elementary schools at Burlington, North Carolina. School A was the most informal situation in that city as determined by a rating scale for evaluating the degree of informality of teaching method. Effects were compared with school C, very formal and

traditional, and with School B less formal than C but more formal than A. The study was limited to group pupil-growth; and objective and quantitative comparisons were made in general achievement, reading, work-study skills, critical thinking, library information, music, and art. Safeguards were taken to make the comparisons valid. No significant differences between the three schools were found in the objective measurements. The author concluded that on the bases of the data collected it would appear that School A has a more effective curriculum program than School B and a program much superior to School C. Lindsay (39) attempted to discover to what extent and by what means continuity is provided thru the curriculum of progressive elementary schools and concluded that selection of curriculum units largely determines this.

Baker (5) investigated the content of spontaneous discussions of children in Grades II, IV, and VI. Records were obtained of ninety-six discussion periods involving 342 children. Baker thought three findings were important from the standpoint of curriculum making: (a) The second-grade children talked primarily about their own activities and their homes while the sixth-grade pupils gave attention to events and happenings quite remote from their activities and their homes and the fourth-grade children were about midway between. (b) Little real discussion of the "meeting of minds" type appeared in the second grade, but in Grades IV and VI it did appear in almost 50 percent of the contributions. (c) The value of discussion as both a teaching technic and as a method by which teachers can learn certain information about their children was demonstrated. Brosnan (10) showed how a continuous reconstruction of the elementary-school curriculum may result in better teaching of children and analyzed the creative, the social, and the tool activities in the elementary-school program. Shaner (59) studied legislative control over the elementary school in the forty-eight states for the seventeen-year period ending in 1940 and compared his findings with J. K. Flanders' study which was made in 1925. The tendency to fix time-specifications to subjectmatter requirements was considered especially significant.

Studies in Secondary Education

Evaluative studies in secondary education deal with cooperative planning, guidance elements in the new type of secondary-school program, types of curriculum organization, and studies of the needs of youth and needs of society. Axford (4) attempted an evaluation of a one-year program in teacher-pupil planning in a small Nebraska high school. His technic and procedures followed the lines of the Eight-Year Study (54). Rice (57) collected information regarding cooperative planning and teaching from 285 secondary schools located in various regions of the United States. He found curriculum modifications resulting, but little realization on the part of teachers that they share with the administration a responsibility for interpreting their work to the public or for gaining the public's suggestions relating to changes in the school. Weitz (73) evaluated the guidance serv-

ices to pupils in a college preparatory course, and Smale (60) demonstrated the improved guidance features and services rendered to youth by the "new type," "basic" or "core" courses in ten of the schools in the California Cooperating Schools project (14). Smale believed that he was able to point the way to a new and fundamental reconstruction in guidance programs for high schools. Helsabeck (33) studied the initial phases of a consultative curriculum service offered on a statewide basis to the secondary schools of Virginia thru which it was hoped that public schools and colleges of the state would be stimulated and their work better coordinated. These curriculum counselors were attached to the staffs of colleges concerned with the education of teachers, but their work centered primarily in promoting the Virginia program for improving instruction in the high schools, particularly in relation to the development of the core curriculum. The venture was found to have functioned helpfully and suggestions were made for further improvements.

Strong (69) evaluating the core courses in selected secondary schools studied the major purposes of the core courses; their subjectmatter content; the place of guidance, general education, and continued improvement of fundamental processes; teacher preparation for the work, nature of pupil activities, and related problems. He defined core course as the "double-period course taught by a single teacher, cutting across subjectmatter lines, sometimes, referred to as 'Social Living,' or 'Basic Course,' but stressing 'areas of life activity' rather than single subjects, and placing special emphasis on individual differences in interests, needs, maturation, and special abilities." Among other recommendations Strong urged that the development of such courses should evolve out of the lives and enthusiasms of the pupils concerned and not be adopted from practices in other schools.

The "broad-fields" curriculum in the secondary school was studied by Gordon (30) to discover what was being done and might be done to reduce the overlapping heterogeneity of the secondary-school curriculum. Among his conclusions were that "there is no such thing as *the* broad-fields curriculum, but rather, there is a series of broad-fields curriculum types"; that educational psychology needs to join educational philosophy on equal terms in reconstructing the curriculum by integrating its discoveries in mental hygiene, remedial rehabilitation, physical factors, and personality adjustment organization; and that the broad-fields curriculum may offer promise for the postwar secondary school.

Norberg (47) investigated present tendencies and conceptions of youth education; Frick (29) examined various experimental approaches to curriculum improvement and found five fairly distinct patterns: efforts to modify and improve content of the separate courses within the present framework, broad-field courses, the unified studies approach, the major functions of social living approach, and the needs of adolescence approach. In the last two, he found a "core curriculum" usually included. Pointing out that the acceptance of any one pattern did not necessarily lead to improvement, Frick recommended that the approach include study leading

teachers to a clearer understanding of democracy and its implications for education, better knowledge of the meaning and nature of learning, and fuller understanding of the nature and needs of the particular community for which the curriculum was being established. He outlined a proposed program for the high schools of South Carolina.

Among the "needs of youth" studies Doane's (22) described the various current usages of the term *need* and examined needs as a basis for vitalizing the curriculum from the viewpoints of faults or shortcomings of society, lacks or shortcomings of youth, and youths' psychobiological needs. He concluded that, in general, courses concerned with personal problems are more desired by young people than those concerned with social problems. The evaluative instruments devised should be helpful to other schools and since the cataloged needs were found to lie largely within the framework of courses already existing in many secondary schools, this study could be a practical aid to schools in making curriculum adaptations.

Bates (6) conducted a survey of the citizens of Norwood, Ohio, regarding their judgment as to what changes in their local high-school program would best make for the educational growth of boys and girls and a survey of the felt needs of youth of the community to determine a dynamic program of education. The surveys were detailed and these data objectively weighed. Four distinct needs were found from the out-of-school youth survey. These were for broader training in vocational areas; the establishment of a terminal junior college; the improvement of a junior placement service and follow-up with a guidance program; and the provision for a community recreational center and program. Recommendations were made in line with these findings. Merkley (43) considered the reactions of nineteen citizen groups to certain elements of the curriculum. Data were gathered from 1304 persons. Morrison and Soper (46) conducted a five-year study of the adjustments which rural secondary schools should make in meeting the needs of rural young people; and Miles (45) likewise pointed out necessary adaptations in the educational procedures that affect the rural curriculums on various levels. Hall (31) examined the usefulness of curriculum offerings to young people who do not go to college; Dotson (23) studied the changing socio-economic background of an agricultural-mining county in Kentucky as a basis for curriculum changes to meet changing needs in the community; Abraham (1) examined the process of curriculum change in one of the secondary schools cooperating in the Eight-Year Study. Reid (56) attacked the problems which recent changes in the secondary-school curriculum have presented to teachers. Weber (72) made a study of the in-service education of secondary-school teachers as a part of the North Central Association studies.

Among the comparative, historical, and survey treatments during the three-year period, Bollman (9) studied the relation of college entrance requirements to the secondary-school curriculum. The secondary school has contributed more to American education and life when it has served youth comprehensively than when it has functioned narrowly as a college-

preparatory school. While some gains in modernizing the secondary-school curriculum have been made, a great deal remains to be done. The study is valuable for its summarizing descriptions of other curriculum studies. Spellman (63) by use of questionnaires gathered facts and general information about the rural Negro population of Wilson County, North Carolina, to determine their relative position in the population, what they do, how they live, their educational status and opportunities and upon these data outlined principles on which a program of rural secondary education could be developed for them. The survey covered 443 of the 1249 Negro families of the county and the questionnaires were filled out at school by the most mature child in each family under the direction of teachers and Jeanes supervisors. Blanks were taken home overnight, if necessary, to obtain complete information. Having found that constant migration of the people was an essential element in the situation at present, he recommended that the schools organize their work on the short unit or project basis by which a child, even tho only a short time in a particular school, might complete something tangible during the time there; and that the program should stress the values of home ownership and family stability. Lantz's careful review (36) of legislation pertaining to the secondary-school curriculum in seventeen states included within the New England, Middle States, Northwest, and Western Associations of Colleges and Secondary Schools compared findings with similar data of the states of the North Central and Southern Associations. His report will be of interest to those concerned with legislative trends.

Evaluative, Comparative, and Historical Studies in Higher Education

Many scientists today consider that concepts based upon the characteristics of classes of objects are of limited usefulness and that concepts defined in terms of the operations which they require are of greater value for scientific progress. Certain educational research is likewise pointed in this new direction and in the period under review toward an increasing number of studies of the evaluative type in which a critical analysis of educational programs has been made in terms of operational objectives as well as of possibilities and attainments in relation to such programs. On the college level Edmiston (24) attempted such an evaluation of the integrated professional curriculum at Milwaukee State Teachers College. Like the Eight-Year Study (54), and the evaluation of the amount of activity present in the New York City curriculum program, reviewed in this magazine in June 1942, Edmiston's study measures the results in terms of stated or implied objectives of the program. She defined operational objectives in terms of what a teacher is expected to do in certain situations. Both operational and situational aspects were studied. It was found that the program was effective in bringing about changes in the behavior of teachers. The study likewise revealed certain weaknesses in the program. Tho some questions might be raised concerning the instruments which were devised, this research

contains valuable hints for those interested in the newer type of evaluational study. The study did not determine whether the program was in fact an integrated program; it did not demonstrate that the objectives toward which the faculty was moving were suitable objectives for bringing about integration in learning or that such objectives could be better attained thru the program at Milwaukee than thru other types of practice teaching. McNaughton (41) carried on an evaluative study of similar nature of the curriculum offered by the School of Education at Stanford University.

Fleck (27) illustrated an interesting approach to the problem of curriculum construction in teachers colleges thru the development and use of resource units for an orientation course for freshmen. Lambert (35) made an analysis of the curriculum of the Teachers College of the University of Cincinnati in which several new technics were used. His distinction between "concurrence" and overlapping or extent of treatment found in common between course units should be noted. Clift (16) carried the appraisal of the curriculum in four Negro teacher education institutions thru seven phases, using a democratic philosophy of education as a source of social and educational values and deriving criteria therefrom. He found that in the schools studied little serious effort had been made to state aims and purposes consistent with an integrating philosophy; that not much had been done to imbue prospective Negro teachers with the desire to become progressively better adjusted as a minority group in American culture; or to provide learning experiences which aimed to translate basic democratic values into behavior patterns. Clift made recommendations accordingly. Offner (49) studied the administrative procedures being used for changing curriculum patterns in selected state teachers colleges in New Jersey, New York, and Pennsylvania. Sister Mary Zembrodt (74) designed a plan for the development of a curriculum laboratory at St. Louis University based upon the needs of teachers.

In the field of the liberal arts colleges, Burkhardt (12) combined various bases used in other college studies in one general extensive study to develop the data needed for establishing a functional educational program at the new junior college at Norfolk, Nebraska. Bliss (8) studied the needs of the student population at Belhaven College as a basis for curriculum development. Hange (32) studied the trends in subjects required and presented for college admission and made suggestions for curriculum changes in liberal arts colleges of the Northwest. Mother Mary McQueeny (42) and Sister Mary O'Neill (52) developed respectively a historical treatment of a Catholic woman's college showing it to have a "core curriculum" one hundred forty years old, the study of religion forming the core, and an evaluation of the courses of study as revealed by the published catalogs of nine selected Catholic women's colleges located in different sections of the country.

One of the important studies of this group is Spafford and others' (62) full treatment of the curriculum of the General College at the University of Minnesota which highlights the values in almost ten years of re-

search and of a continuous process of self-criticism and evaluation. The Cooperative Study of General Education (21) and similar undertakings are reviewed elsewhere in this chapter.

Cooperative Studies and Surveys

Among the experimental studies now under way in the elementary-school field are the Sloan Foundation Studies of Applied Economics in three rural regions—in Kentucky where the study centers on food under the guidance of the University of Kentucky (58); in Florida (51) where the University of Florida is sponsoring a program on housing; and in Vermont where a clothing project sponsored by the University of Vermont has been in operation only a short time and is not yet reported. The Kentucky experiment has been evaluated at each stage of its development. All of these projects need to be carefully evaluated in terms of children's needs, interests, and opportunities. It might be valuable, likewise, if similar projects were initiated in rural communities of higher economic level.

Leonard and others (37) under the sponsorship of the Society for Curriculum Study reported on 154 studies of modern education, carefully selected on a basis of thoroness and reliability. These data give accumulating evidence that modern education while ensuring a high degree of efficiency in developing both old and new skills, including the three R's, is making steady progress toward attaining likewise important values in the social-personal development of pupils. The story of the Progressive Education Association's Eight-Year Study of thirty secondary schools was continued in a report (54) on the curriculum which deals with both "the what and the when" of the developing programs in the various schools during the years of that study. The Southern Association Study (61) reported on evidence of student achievement in the cooperating secondary schools of the Southern Association Study. The Michigan Study (44) of the secondary-school curriculum has issued its first five-year report. A number of reports have been issued on the California Cooperating Schools project (14) regarding curriculum patterns and types of organization developing in that state. The North Central Association has issued reports (48) on its study of general education in the American high school. The American Youth Commission's final report (3) has many implications for curriculum workers, altho the general direction in which these should point is, because of swiftly changing economic conditions confronting our youth today, less clear than when the research findings were being assembled. A report of other cooperative school projects (28) going on in various sections of the country has been issued by the Florida Curriculum Laboratory as a joint project of the University of Florida and the University of Oregon.

On the college level the period has brought forth the important findings of the Commission on Teacher Education (17, 18, 19) and the Evenden progress report (25) on the Sloan Foundation curriculum study fellowships in teacher education. The reports of the five-year Cooperative Study of

General Education (21) are pending, as is the report of the Commission on Terminal Education of the American Association of Junior Colleges, to be published by Harper's in 1945.

The period has likewise seen the culmination of some important school surveys which have placed emphasis upon curriculum problems. In *Louisiana Looks at Its Schools* (40) the Louisiana Educational Survey Commission makes a contribution in demonstrating that democratic practices can be effectively used in shaping a state's educational policies. Strayer (65) has brought out his report of the schools of the city of Boston, of which Volume V (66) and Volume VI (67) are pertinent to this review, and his report on the school system of the City of New York (68). Canada and Newfoundland Education Association (15) has presented a report of a survey of its schools. The Virginia Education Commission has issued the report of its research committee (71) with findings on the curriculum, and the Alabama State Survey is completed, altho the report is not yet available.

Needed Research

There is apparently some popular reaction from modern practices. This reaction is not supported by research. Research could, however, assay the amount of this reaction and ascertain its causes. Many changes in curriculum content have taken place during the war years. These changes have usually been made in response to emergency demands and have not been carefully thought thru and evaluated. Research is needed to test the value of these programs. What are the best types of intercultural education, for example? Will the study of Spanish promote understanding of our South American neighbors, or could equally good or better results be obtained in less time thru planned units in the social studies? Should such content be offered in separate units, or should it permeate many phases of the whole curriculum?

Is the issue of *integration* settled, or is further study required? What is the best type of education for the period of early childhood? Are nursery schools and kindergartens essential for all children? Is there any practical substitute for children living in sparsely settled areas? What other educational extensions should the public schools consider, and what curriculum changes would such extensions entail?

Among many such unsolved curriculum problems there are at least four major areas in which much research remains to be done. These have to do with (a) types of curriculum organizations; (b) the effects of particular types of curriculums upon particular learners; (c) problems of the relationship between the school's curriculum and wider areas of living; and (d) problems of sequence. These issues need to be described and appraised. The curriculum of the future, likewise, needs new instruments and better perfected instruments of evaluation.

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CHAPTER III

Methods of Teaching

GEORGE C. KYTE

IN THE June 1942 issue of the REVIEW OF EDUCATIONAL RESEARCH, Corey and Mook (2) summarized fifteen investigations dealing with methods of teaching. These reports were published during the three years, 1939, 1940, and 1941 and dealt with general procedures or general methods employed by teachers. The present summary includes the sixteen research studies published during the three years, 1942, 1943, and 1944, which included statistical treatment and evaluation of general methods of teaching.

Comparison of General Methods

Over one-third of the published research studies dealt primarily with one or more of the general methods of instruction. Five of the six investigations were experimental in nature.

Utilizing the weekly four-hour laboratory-and-quiz sections in freshman chemistry, Thelen (15) compared the results achieved in (a) two control groups following different conventional procedures and (b) each control group and the experimental group following a modified procedure. Students in one group of control sections used small-scale laboratory equipment in carrying on their experiments. Those in the other control sections used the conventional-sized equipment. Both control groups followed the instructions in the same laboratory manual in conducting and writing up their experiments. Students in the experimental sections used methods involving (a) class evaluation of the learning objectives of each activity, (b) thorough understanding and planning of the procedures used, (c) use of sound scientific procedure in solving problems, (d) performance and participation with understanding, and (e) critical consideration of the procedures including generalization, reexamination, and replanning. In the experimental sections instructors followed "detailed known plans devised by the experimenter" in guiding their students. The students were not segregated during the two one-hour lectures given weekly. All studied the same subjectmatter.

At the beginning of the college year, "the freshman-week battery" of psychological and other tests were administered to all. The students registering in the chemistry course were given also a four-hour objective test designed to measure knowledge of "chemical concepts" and "certain abilities to think critically in freshman chemistry." Another test of this nature was administered at the end of the first semester and a third test, at the end of the year. Differences in gains were treated statistically. The resulting data indicated quite marked reliable differences in favor of the experimental groups over both control groups. The superiority of semi-

micro equipment over macro equipment was found to be a statistically unreliable difference.

Ward (16) compared two methods of teaching chemistry in high school: (a) the "traditional textbook method" with subjectmatter as "the end in itself," and (b) the "modern method" using subjectmatter "as a means to the end." In the new course of study, the latter method was indicated to be "pupil activities approximating life situations" in keeping with the "interests, needs, and capacities of the pupils." Twenty-one classes in five high schools, five teachers, and 420 pupils participated in the experiment.

Each teacher taught both methods. Equivalent groups were established by the use of intelligence quotients, previous scholarship averages, and scores made on two tests. One test was "noninformational or functional" in nature and the other measured "chemical information." The same two tests were administered at the end of the semester and differences in scores computed.

One case of significant difference favored the textbook method but eleven favored the modern method. When the results in the two types of classes taught by the same teacher were compared sixteen differences were found to favor teaching by the modern method; eleven of the sixteen differences were significant. Pupils with high intelligence quotients succeeded "equally as well" following either method but pupils with low intelligence taught by the modern method achieved better results than did comparable pupils taught by the traditional method.

Kahn (7) conducted a complex experimental study to compare the laboratory method of instruction with individual demonstration. The laboratory periods of classes in elementary college biology were taught by various combinations of procedures. The experimental program required the use of eight classes to determine (a) relative effectiveness "with respect to acquisition and retention of factual information," (b) the most beneficial way of combining demonstration and laboratory work, (c) the results obtained by application of "the new method," (d) the relative effects on the various groups of students enrolled, and (e) relative "effectiveness from the standpoint of certain general objectives of science teaching."

Each experimental group was paired with a control group, the number of pupils per group ranging from eleven to seventeen only. Pretest, post-test, and delayed retention (a week or two later) tests were administered to all classes. The Thurstone Psychological Examination was used to determine intelligence by percental ranks. From the treatment of the data, the following findings were obtained: (a) larger gains in final and delayed recall by the experimental groups over gains by the control groups were statistically different; (b) use of the new method for review purposes favored significantly the experimental group; (c) use of the individual demonstration was more effective than use of the individual laboratory method alone in the amount of subjectmatter learned and retained; (d) when included at the end of a period with a specific unit of work, the individual demonstration was more effective; (e) students who profited

most from the introduction of the individual demonstration were working for a degree in science and also the students of relatively low intelligence regardless of curriculum; and (f) there was a statistically significant difference in favor of the pupils of relatively high intelligence in the experimental groups over the corresponding students in the control groups.

Everote (5) compared two high-school courses in chemistry in which different methods of teaching were employed. The control classes took the regular year course and the experimental classes, a course in experimental science with practical emphasis on chemistry in agriculture. The study of one of the large units, "Agriculture in Southern California," in the experimental course was observed and studied critically by the experimenter.

Matched students from the two groups resulted in 230 pairs with records for the year and one hundred pairs with school records for the following year. Mean grade points "coincident with science courses" were computed. Also the students in the one hundred pairs filled out an "opinionnaire" of seventy questions dealing with agricultural issues. Statistical treatment of the data disclosed gains in the experimental groups significantly greater than those in the control groups at the .01 level. Changes in the thinking on the issues also distinctly favored the experimental group.

Jayne (6) investigated the information gained and retained by (a) high-school pupils listening to a lecture and (b) pupils seeing a motion picture presenting the same material. The experiment was conducted in ten freshmen general science classes enrolling 271 pupils. Two teaching units were prepared, the first being an elementary presentation of relativity and the second, a study of petroleum production. The two lectures were prepared from notes taken by repeated reviewings of the respective films. The lectures were illustrated by blackboard sketches and diagrams similar to the animated drawings in the films. One teacher gave the lectures to all classes. Five classes heard one lecture and the other five classes saw the corresponding motion picture. This latter group heard the second lecture while the former group saw the corresponding picture.

A pretest was administered on the school day immediately preceding the lecture and the showing of each film and a post-test on the school day immediately following. Retention tests were administered as follows: pairs of classes in Group I, three weeks after the lecture and showing of the film; Group II, six weeks after; Group III, nine weeks; Group IV, twelve weeks; and Group V, fifteen weeks after the exposures. The gains were computed and treated statistically. The immediate gains made in all ten classes from the lectures were significantly larger than those made from the film presentation. Differences in the amount of retention were significant for all periods except the longest period but the critical ratios tended to decrease with the passage of time. The lecture method "suffered greater loss from forgetting" than did the film method. However, the former "retained its superiority in gain."

Luderman (11) used a checklist with students to obtain their evaluation

of college teaching. They ranked five methods and gave reasons for their choice of methods. Composite scores of the rankings were discussion method, 206; lecture, 175; question and answer, 170; socialized method, 163; and special report, 87. The reasons stated by the students indicated that (a) there is recognized value in each method; (b) students enjoy and profit from classroom participation; (c) the lecture is considered the best ground covering procedure; and (d) college teachers should employ a mixture of methods to get the best interest and effort of their students.

Individual Methods and Group Methods

Utilizing four classes of college freshmen, Karp (8) taught the mechanics of English composition by two methods. Thruout one semester, he used an individual method of instruction in two classes, meeting each of five students for ten minutes of a class hour in the course of the scheduled class time per week. This schedule afforded each student a total of seventy minutes of individualized instruction during the term. Each of the other two classes was met in the conventional manner, the students receiving instruction in a group during a total amount of semester-class-time of 1350 minutes.

At the beginning of the semester, the Council on Education Psychological Examination and the Cooperative English Test, Form O, were administered to all four classes. At the end of the semester, Form P was administered; three months later Form O was administered again to obtain retention test scores. Numerical gains were computed and treated statistically. All groups made statistically reliable gains. All but one of the classes taught by the group method continued to gain. In general, students taught individually made greater numerical gains than did the students taught in groups. With the pupils of highest intelligence, individualized instruction was more effective than group instruction but with the students of lowest intelligence, the group method produced better results.

Klugman (9) carried on a study in arithmetical problem solving to determine whether children in the fourth to sixth grades could solve problems better when working in pairs than when working alone. The pairs were equated according to sex, race, grade in school, chronological age, and intelligence quotients. Using two forms of the Otis Arithmetical Reasoning Test, Klugman carried on the program with a careful alternation of pupils and testing to control practice effect, all pupils solving the problems in one or the other of the forms working as individuals and then on the opposite form working in pairs. All time limits were removed. The statistically significant results included: (a) when working in pairs the pupils average 7.27 problems correctly worked as against 6.18 correct when working alone; (b) in the pairs they averaged 1238 seconds of working time as against 1054 seconds when working alone; (c) results in the subgroups—boys, girls, whites, and sixth grades corresponded to the general findings. Other groups also tended to agree with the total group results but the critical ratios fell below 3.

School Excursions

The one investigation dealing with school excursions, by Clark (1), was a carefully planned and soundly directed experiment. In reality it consisted of four independent experiments involving different situations. It included four experiences planned for sixth-grade pupils: (a) visit to the Egyptian room of a museum; (b) trip thru a daily newspaper's printing plant, (c) excursion by streamlined train and return by bus; and (d) trip thru a main telephone exchange. Two weeks of instruction on the content were devoted to each unit, the experimental classes including the excursion and the control classes studying printed or mimeographed materials supplemented with pictures. A "zero control school" was given no instruction in any of the units.

Standardized forms of tests were constructed, tested, and then administered in all groups: (a) pretest, (b) final test, and (c) retention test given one month later. Also, at the conclusion of the instruction period, children indicated their likes and dislikes regarding each unit and stated the activities they would like to continue. The data from the test results, statistically treated, yielded detailed findings. The groups visiting the printing plant and the telephone exchange made higher scores than did their comparable control groups. Only the boys taking the train and bus excursion scored higher than did the boys in the control group. The groups visiting the Egyptian room scored lower than the control groups. But there were no statistically significant differences in absolute retention between the excursion-groups and the nonexcursion-groups except in the case of one group visiting the printing plant, which made significantly less gain than did the control group. The reactions obtained from the pupils indicated that greater variety of interests were aroused in the children taking the excursions and a wider variety of activities they wanted to pursue.

Aural Materials and Printed Materials

Rulon and others published three investigations comparing the effectiveness of phonographic recordings with comparable printed materials. The subjectmatter covered parts of recent world history from World War I (1918) to World War II (1939). The first study (12) dealt with knowledge gained through their use alone." The printed matter consisted of the recordings' content presented in playlet form. In seventeen representative high schools, matched groups were used. Three tests, each containing twenty-five true-false items and two five-item historical sequences, were constructed. They were "written from the type-script of the recordings." The procedure followed was: Tuesday, pretest; Wednesday, exposure to materials; Thursday, second test; and the following Thursday, third test. The experimental group heard the records and the control group was exposed to the reading matter for the same length of time. Every group took all three tests but the six possible testing sequences were followed. The

differences between pretests and each of the two post-tests were treated statistically. Initial gains were larger in the control groups than in the experimental groups, the "three top schools" yielding significant results in the reading-matter group. In the retained gains, however, the groups studying the playlet were not significantly superior to the groups listening to the recordings.

The second experiment (13) included the study of a unit including (a) the recordings for the experimental groups, and (b) the same contents in textbook style for the control groups. Each of the two tests constructed contained thirty-five true-false items and two five-item sequence exercises on the common content and sixty true-false items and four five-item sequences based on the supplementary materials used. Small groups in each of four high schools were used, pursuing the following schedule: Friday, pretest, thirty minutes; Monday thru Thursday, four class periods of forty minutes of instruction; Friday, final test, thirty minutes. The tests were administered so that one-half of each group were given Form A as a pretest, and the other half, Form B. The final tests were distributed so that each pupil received the opposite form to the one he used previously. In three schools eleventh-grade classes were included and in one school, tenth-grade classes. Obtaining no statistically significant results, the authors concluded that under the conditions followed, the recordings did not exhibit "any superior effectiveness in teaching the informational part of the material."

The third research study (14) was conducted to compare the "phonographic recordings with printed materials in terms of motivation for further study." Two tests were constructed, each containing sixty true-false items and four five-item sequence exercises. Matched groups in eight high schools were included in the experiment. The schedule and procedure were as follows: Monday, regular classwork unrelated to the experiment; Tuesday, pretest; Wednesday, (a) recording played followed by class discussion in experimental groups and (b) text materials read for the same length of time followed by class discussions in the control groups (five minutes before close of this period every pupil in each group received the same additional reading materials related to the contents to which they had been exposed); Thursday, Friday, and Monday, regular classwork only; Tuesday, final test. Alternation of tests as pretests and in each class was the same as that followed in the investigation (13) summarized above. The statistical results obtained were so conflicting that neither procedure was proved to be more effective than the other.

Study Procedures

Four investigations dealt with study procedures. Two of the research studies by Di Michael were made possible by the establishment of two equated groups in a high school. Groupings were made on the basis of sex, intelligence quotient, and chronological age. The experimental group was enrolled in a course on how to study, held two forty-five-minute periods

per week for twenty-seven sessions. During these same periods, the control group was in regular study classes "doing their assignments under the supervision of the regular teacher." In all other classes the pupils were mixed.

For one investigation (3), Di Michael constructed a test of 224 items, including true-false, multiple-choice, matching, and recall forms of testing. Statistically, he established its reliability to be satisfactory. It was designed to test the pupil's knowledge of good study habits. It was administered at the beginning and at the close of the experimental period. The pupils taking the course entitled "How to Study" substantially increased their knowledge of good study skills, making much greater numerical gains than did those not in the course. The superior pupils in the experimental group profited more than all others.

In order "to evaluate experimentally, the transfer effects of the how-to-study course upon the achievement of pupils," Di Michael (4) administered standardized achievement tests in medieval history, Latin, elementary algebra—subjects of the courses which the pupils were taking. The gains in achievement favored the experimental group, this result being especially true of the pupils in the middle groups of mental ability. The only difference of statistical significance was found in the comparison of gains by the superior students taking the how-to-study course over the gains by the superior students in the control groups.

Krause (10) compared two methods of study in science, using eight science classes in the fifth and sixth grades, involving 102 matched pairs. All pupils read the same chapter in a science book and then were given "an explanation of how to construct a test," including four types of standardized forms. The students were given some time to practice the constructions. Each class was divided into two matched groups. The pupils in one group formulated tests of their own; and pupils in the other group answered in complete sentences the questions included for each topic in the chapter. The time assigned for these activities was the same for all groups. The investigator prepared a new-type test covering the points asked for in the questions answered by the nontest-making group and administered it to all pupils. A percentage of differences of 10.2 was found in favor of the group formulating tests.

Wittenborn and Larsen (17) made "an attempt . . . to evaluate forty-two items in a study habit questionnaire," filled out by college students in the first semester of German. The course was taught to develop ability to read German with ease and pleasure. The responses of the students to the items in the questionnaire were validated by comparison with (a) the total scores earned on the Cooperative German Achievement Test, Elementary Form O, and (b) the course marks earned by the students at the end of the first semester. Of the various items in the questionnaire specifically dealing with methods of study applied to learning German, the statistical treatments indicated those which shed light on phases of studying included. They point to the importance of (a) understanding what

the instructor wants to achieve; (b) mastering each assignment or lesson; (c) working the exercises included; (d) applying the declensions in the exercises; (e) identifying the parts of speech included in each sentence; (f) reading ideas rather than just words after the first reading; (g) reading until the thought comes in German; and (h) studying and understanding the corrections in one's own work.

Conclusions Regarding the Publications

A review of the published literature and the three summaries covering general methods disclosed some trends to be noted. In the recent three-year period reviewed, the number of publications of a distinctly research nature exceeds the number in each of the two preceding periods. Also, a larger number of the recent studies were doctoral dissertations. Fourteen investigations were experimental studies in which intensive use of statistical technics was generally made. Experimentation with teaching on the college level was marked. Methods of teaching the sciences in secondary schools and in colleges received considerable attention. Many investigators dealt with classroom procedures involving various aspects of greater pupil participation. The effects of certain teaching methods on pupils of different types were investigated more widely than in the previous periods. The analysis of the research literature leads to the general conclusion that the recent period has been far more fruitful than the two periods preceding it.

The body of general literature on methods of teaching was as extensive as ever. There was a wholesome tendency in it to cite the findings of research and the summaries of investigations. The many articles including discussions of or allusions to methodologies used in teaching and training the personnel in our armed forces suggest to research workers that, after the war, sources of accounts regarding procedures used and data accumulated should be investigated. The resulting studies should furnish valuable findings especially with respect to methods of teaching adults.

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CHAPTER IV

Psychology of Learning

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THE SCOPE of the references in this chapter is somewhat more restricted than in the preceding review (102), for which the title "Educational Psychology" was used as a chapter head. Since this field interpenetrates many of the subjects of special issues of the REVIEW OF EDUCATIONAL RESEARCH it was decided to include here those aspects of educational psychology dealing with learning, which could be viewed as acquired changes in the behavior probabilities of an individual brought about thru a definitely controlled environment. Learning studies were selected only if they were broader in their implications than any one academic field, and only when they emphasized the role of the learner rather than that of the environment, whether physical or social, instructional or clinical. As a consequence, it is believed that a number of studies, analytical as well as experimental, are here reported without trespassing too much on fields marked out for other issues.

A few volumes of interest to the student of learning have appeared. *The Psychology of Human Learning* by McGeoch (56) was published posthumously and provides a descriptive and critical account of various phases of learning. While the greater portion of the volume is taken up with an exploration of serial memorization, the earlier and later chapters deal with many problems and generalizations closely related to classroom experience. *Man and His Works* (98) contains the gist of Thorndike's psychology, including his more recent work on the specifications for a community which make for general goodness of life. The ten chapters constitute the William James Lectures given at Harvard in 1942. The Forty-first Yearbook (34) presented authoritative statements of the basic theories of learning—conditioning, connectionism, and field theory. The contributions, particularly those by Gates, Guthrie, Hartmann, Hull, Lewin, McConnell, and Sandiford reveal that the theories have much in common and much that is significant for education. Other chapters deal with motivation, (Ryans), emotional behavior (Anderson), practice (Stroud), language and meaning (Horn), problem solving (Brownell), and the curriculum (Buswell). A number of chapters relating to various aspects of learning are to be found in the two-volume treatise edited by Hunt (41), particularly those by Bateson, Guthrie, Mowrer, Murphy, and White.

Bibliographies and reviews of research for the field of learning as a whole should likewise be noted before turning to reports of specific studies. Ryans (81) reviewed the researches in learning with especial significance for education which appeared in six journals during the years 1936 to 1940, and selected references on educational psychology are presented by Buswell and Sherman (12). Twenty-six studies in the psychology

of learning, which he considered especially significant, were reviewed by Munn (61).

Motivation, Fatigue, and Aspiration Level

Motivation, as such, was less a problem for investigation than a theme for discussion and general enlightenment. Various aspects of motivation and incentive were treated in some detail by different writers in discussing civilian morale (105). However, the effectiveness of praise or blame as an incentive was shown as a result of a detailed and carefully controlled experiment (85), to be dependent in large measure on the test situation and the tester.

The effects of failure received some attention. Interrupted tasks, those completed correctly, and those resulting in failure (poorly done), consisting of peg puzzles, mathematical problems, and jigsaw puzzles, failed to show the expected differences on attractiveness preference ratings by the subjects, tho failure tasks were generally rated less attractive (14). Experienced teachers will recognize some of the common and seemingly normal characteristics of pupil behavior in an experiment in learning card sorting. The high-school seniors who served as subjects were observed when they succeeded and when they failed. Among the effects of failure were the following: (a) a decrease in general motility level, sharp increase in daydreaming, reduction of social responsiveness; (b) dogged but ineffectual continuation of the task or persistent, nonadjustive behavior; (c) a process of "decontextualization," which splits off the activity from its social frame of reference and reduces its contact with reality (87). Nonpromotion as a consequence of failure was critically examined and found on every count not to benefit the child (83).

Mental fatigue, in terms of reduced efficiency in solving problems, was greater in homogeneous than in difficult but heterogeneous work for subjects of normal and of superior intelligence (62). The psychological effects of doing a monotonous task were explored, using preschool children and college sophomores as subjects, who were required to draw "moon faces," *ad nauseam*. While both groups demonstrated similar postural and vocal patterns and sought substitutions in the form of fantasy, talking, and whistling, the children satiated sooner, introduced more profuse and elaborate errors and distortions, and found it harder to mechanize the task and substitute motor or ideational activities (11). Bartlett (2) made a significant observation in pointing out that fatigue in skilled work cannot be measured as if it were the same as simple muscular fatigue since the operations involved are marked by complex, coordinated, and accurately timed activity. Hence right actions may be performed at wrong times. The stimulus field splits up and becomes a collection of unconnected signals for action, and serious lapses of specific reactions occur.

Considerable interest is now evidenced in the nature and effects of aspiration level. Clearly, low levels, if they are the highest a pupil can attain, need to be dignified so that he will not set his aspirations on the

phantasy level and forever be doomed to disappointment. One experiment (42) combined an interesting motivation differential with aspiration level. Motivation in dart-throwing, based on expectation that scores would be made public (vs information that the subjects were "just practicing"), produced no significant differences in the scores of university women. Significant differences were found, however, in the level of aspiration as compared with scores actually made when the directions were shifted from a statement of hope to expectation of attainment. Three levels of aspiration were defined for an experiment (72) using addition and cancellation: the "maximum"—that performance which the subject considered to be the best he could achieve; the "actual"—that which the subject expected to equal on the next trial; and the "least"—that below which the subject was certain he would not fall. Correlations of the "least" with the others were negative, while those between the "actual" and the "maximum" were positive (.45 to .84). Festinger (23) subjected a group of college students to synonym-antonym information tests, and obtained their aspiration level for the next test in various ways: reality-irreality—the score they would "expect" and the score they would "like"; group—comparison with a high school, college, or graduate group; and position—comparison with the group average. Shifts in aspiration level were related to the strength and direction of the driving forces, the restraining forces, and the potency of certain frames of reference, an operational definition of which was derived. Rotter (79) in a study reported in three parts examined the effects of variation in the technics of studies on aspiration level, particularly the phrasing of instructions. He set up an experiment in which a steel ball was propelled along a wooden groove with a short cue to the middle of a series of regularly placed depressions. Significant group differences were found, and he concluded that such personal traits as feelings of inferiority and emotional instability do effect the level of aspiration, and that differences in the level are due more to patterns of factors than to specific factors. On the basis of earlier experiments Sears (86) concluded that the aspiration level response forms a part of a cluster of associated personality attributes, and Wren (110) found that vocational aspirations were related to dominance, familial occupations, certain abilities, education, and income but not to age, marital status, employment stability, and length of supplementary education.

Sensorimotor Learning and the Acquisition of Motor Skills

A number of experiments throw light on the processes involved in sensorimotor learning. In a symposium on physical fitness (8) experimental biologists reviewed the influence of psychological factors involved in motor performance, including efficiency, boredom, and fatigue. The proper length and distribution of rest periods has long been a matter of uncertainty. One-minute trials for a period of twenty-five minutes a day (using the Koerth pursuit rotor) produced little difference in daily im-

provement when rest periods distributing the learning were varied in length and frequency with different student subjects (36). A similar experiment (4) indicated that the rest periods were of value at first, but loss did not follow increases in their length. It was proposed that "true learning is obtained learning plus the difference between interference and warming up."

Experimental results favored specificity in widely differing situations. It seems to be the rule, for example, in carelessness. In such closely comparable tasks as reproducing lines 100-110 mm. in length, and canceling A's, S's, B's, and K's, Thorndike (99) reported that the correlation between the scores, the individual differences in which represented carelessness, was less than .30. Trait specificity was also supported by experiments in which practice was called for in block-packing, steadiness, speed of movement, slow movement, stick balancing, tapping, and card sorting in which intraindividual differences were greater than interindividual differences (68). Junior high-school boys were given equivalent tests (67) to determine whether the curves tend to converge, diverge, or maintain the *status quo*. The latter proved to be the case, thus confirming other studies which indicate a "genetic determination and uniqueness of motor skills," and point to the desirability "of early specialization along the lines of the individual's greatest aptitudes" in motor skills.

A few interesting experiments have been reported involving improvement in athletic skills. Retarded speed until a high level of accuracy was obtained was found to be less successful in developing both accuracy and momentum in what was called the ballistic movement. In batting a ball, in an experimental setup, the use of speed from the beginning of the training period was more effective (25). Improvements in speed and accuracy of total bodily movements were studied by analyzing the fencing lunge from the point of view of initial status, rate of learning, and maximum end points (21). In an unusual experiment involving junior and senior high-school boys and college freshmen (103) "mental practice," in which the subjects imagined themselves dart-throwing and basketball-shooting, was almost as effective as actual practice.

Memory and Forgetting

A variety of experiments on retention followed no well-defined pattern. Using the familiar, paired-associates technic Stroud and his collaborators (93, 94) found, contrary to expectations, that over a period of two weeks recall trials did not prove superior to presentation trials, and that reviewing by rereading was equally effective one day, fifteen days, and twenty-nine days after learning. Attitudes were found to influence recall on a paired-associates test composed of items of various degrees of compatibility made out for each child. The pairs at either end of the attitude scale were retained with greater success than the indifferent items in the center, but items in the control series, consisting of incongruous pairs, were retained better than in the test series (70).

A larger number of massed than of distributed repetitions of readings of poetry by 150 college students were needed for learning, tho the total elapsed time of the latter was pointed out as an important consideration in over-all efficiency (10). The part method likewise proved superior for four graduate students in memorizing piano music (64). In reading piano music a photographic study of eye movements showed that memory span and duration of reading pauses were influenced by the complexity of note relations, and by melodic and rhythmic factors (104). Growing complacency with the conflict theory of forgetting as opposed to that of fading or disuse received a jolt from the Columbia School of Investigators (7). Three subjects were trained to draw 150 lines, blindfolded, three, four, five, and six inches in length, and then made the same drawings after varied periods of time up to eight months. The average percent of error increased as a function of time.

Three articles containing discussions of experimental findings should perhaps be mentioned. The difficulties some have had in applying the technics of negative practice for unlearning bad habits were explained by the author (20) of the gamma hypothesis. Buxton (13) reviewed the literature on reminiscence, which is defined as an improvement in recall without practice after original learning. The phenomenon is apparently widespread and related to various aspects of the learning task. In most of the memory experiments of the past, emotion has been one of the variables which were supposedly controlled. It has become increasingly evident, however, as pointed out by Rapaport (74) that in the actual processes of remembering and forgetting, emotions are very important. Evidence of the part they play was gathered not only from psychological theory and experimentation, but also from contributions of psychoanalysis, hypnosis, and pathological memory phenomena.

A few studies in retention were reported which were conducted in the school situation. Two hundred twenty-nine ninth-grade algebra pupils forgot 10, 20, and 20 percent of their fundamental operations four, eight, and twelve months later respectively, but gained 2, 5, and 10 percent in problem solving, which latter may or may not have been due to their concurrent practice in geometry during the year (48). The facilitating effect of an audience on remembering was demonstrated in the case of college students who, in retelling a story to a group, recalled more ideas than when retelling to the experimenter (32).

Associative Learning: Set, Effect, and Transfer

The term conditioning has been used loosely to apply to all associative learning and even to learning in general, and Maier and Schnierla (57) have done well to call attention to this and to urge that conditioning be restricted to apply only to the first stage of associative learning, the development thru contiguity by a neutral stimulus of power to excite, a response it previously did not control.

Since the pioneer experiments of Bryan and Harter, psychologists have done relatively little with the Morse Code. Taylor, after further explorations, found among other things that speed of learning to receive was unaffected by whether similar or dissimilar letters were taught together, whether the instructor transmitted individual characters at high or slow speeds, or whether correct responses were reinforced immediately or after a short delay. He also concluded that plateaus were not common in curves of learning to receive, and that the negatively accelerated curve was typical of learning to send.

The concept of set, which has an important bearing on educational theory and practice, historically in Herbart's "preparation," and concurrently in questions of motivation, need, and in lesson assignments, was critically reviewed by Gibson (26), who found a number of false assumptions and ambiguities in the use of the term. The importance of specificity in set was revealed in an ingenious experiment (30) in which subjects who were told that a light would move during most of the trials perceived movement more frequently than did those instructed that movement would occur in only some of the trials. A set developed by the subjects, in finding that the solution for several successive problems lay in a procedure common to all, was viewed as created by special factors in the situation as a result of intelligent assumptions (55). A motor set was introduced by an ingenious procedure (77). Subjects who had established a reliable tapping rate were asked to return to it after faster and slower rates had been forced on them; but they were so influenced by the intervening experience that in all cases the natural rate changed in the direction of the forced rhythm.

The "pep talk" is in for a doing over, if Yates' success in "psychologizing" five out of six amateur boxers into winning can be repeated (111). The desired set was provided by creating the conviction of success, showing the subject how to relax, presenting "slogan-like" ideas, following the set by rest or sleep, and providing the occasion for success quickly. The old game of gossip was thrown into experimental form (101) by having a subject write a passage that had been read to him twice. What he wrote was read to another, and so on. After twenty or thirty individuals had passed the word along, the changes were found, as expected, to follow such principles as simplification, trend toward familiarity, rationality, etc. But when a set had first been established by the reading of allied material, the changes occurred in a definite direction.

Direct educational implications for the use of reward and punishment were indicated in the results of an experiment with a punch maze, using children six to ten years old as subjects (37). In one series a bell was rung when each hole chosen was wrong; in a second series the bell was rung only when each hole chosen was right. The reward or positive guidance was superior for the group as a whole, for all ages tested, and for all four maze lengths used. The effect of knowledge of results in training in pitch discrimination (two and one-half hours on five successive days) was

to produce marked improvement, particularly in those initially poorer (17). The effect of reward and punishment in perception was discovered in an ingenious experiment by Schafer and Murphy (84). They employed cleverly drawn ambiguous figures, each containing two facial profiles which had previously been viewed twenty-five times separately, accompanied either by a monetary reward or penalty. They found that four-fifths of the perceptions were of the hidden profile that had previously been rewarded, thus indicating that autism, "the organization of cognitive processes in the direction of need satisfaction," plays a role in figure-and-ground observations. Punishment was likewise found to come off second best in an experiment (5) with college students employing a stylus maze and a verbal maze. Shock was administered for some but not for all of the errors, and those for which it was administered were not eliminated any more rapidly than the others. In fact, some of the shocked errors persisted longer. The phenomenon of spread of effect obtained for reward was confirmed in an experiment (22) with a punchboard maze, and the effect of punishment in the opposite direction was shown to be not comparable in amount with that of reward.

Educational psychologists have for some time interested themselves in "transfer," in the facilitation of or interference with a performance produced by previous more or less related training. But educators should perhaps be equally concerned about confusions wrought in performances earlier acquired, by later experiences, which goes by the name of retroactive inhibition. Hamilton (31) went to some pains to show that the later task interferes with the one earlier completed if the responses called for are different, but that retroactive facilitation takes place when the responses are identical. In a detailed review of the literature on retroactive inhibition, Swenson (96) concluded in favor of a transfer theory elaborated in terms of "organizational and meaningful features that cause or prevent positive and negative transfer, rather than purely in terms of identical elements. Conditions contributing to the construction of well-organized patterns of knowledge and skill are those for which retroactive inhibition is at a minimum." Implications for education were emphasized. In an experiment (95) involving 332 pupils from fourteen different second grades who were taught 100 number combinations, she found that those taught by a generalization method seemed to have an advantage over those taught by drill, or by a common practice method.

The progress in learning made by students from progressive and from traditional schools was reported by Aikin (1), by Chamberlin and others (15), and by Smith and others (90) in Volume III of *Adventure in American Education*. Pressey (71) and his co-workers in a number of studies showed that the usual slow progress thru school and college is unnecessary and wasteful, and that accelerated groups, merely by taking "extra subjects" made a better scholastic and extracurriculum record than equivalent groups taking the usual time, or a longer time, for college graduation.

Problem Solving, Concept Formation and Critical Thinking

A detailed analysis of the processes of problem solving was presented by Johnson (46), who cited a bibliography of 169 titles. The solutions arrived at by a group in which a problem was discussed were found to be superior to those of another group where it was not. A number of factors were suggested to account for these results: the increased range of suggestions, the criticisms they received, varied interpretations of the facts, and the larger fund of information available (100).

Piaget (70) reported an analysis of the development of the number concept in children, and his work has been at least one of the sources of stimulation for other workers in this field. Long and Welch, following Mill's joint method of agreement and difference in inductive reasoning, found that those who were able to give adequate verbal explanations on picture block tests did better than those whose explanations were inadequate (106), that qualitative changes (shifts in the abstractness of concepts) were particularly effective in reducing the score (53), that difficulties increased in passing from the first to the higher levels of abstractness (objects, species, classes), and that better progress was made by those who discovered the first principle without any hint (54). Goldstein and Sheerer (29) concluded, on the basis of various testing procedures, that abstract thinking includes, in addition to the "real" stimulus, such modes of behavior as assumption of a mental set, shifting from one aspect of a situation to another, holding in mind simultaneously various aspects of a problem, abstraction of common properties, and planning ahead ideationally. Eight lesson units aimed at giving instruction in critical thinking were tried out on 129 high-school seniors over a ten-week period and resulted in significant gains over the control group, as measured by the Watson-Glaser Tests of Critical Thinking, and by evaluations by students and teachers. Results indicated that improvement in critical thinking ability was general for the individual, but skill in formal reasoning was specific to the field of training (28).

A somewhat different approach to the problem was tried by Cronbach (18), who prepared a checklist of 120 considerations which might be important in the formulation of the reasons for the choices of college students between the two major candidates in the last presidential election. In many cases checking of invalid arguments pointed to inadequate patterns of thinking. A statistical formulation of logical concepts was advocated by Dodd (19) in the interest of greater precision. Induction was then operationally defined in terms of statistical formulas, deduction as correlation indexes, the syllogism a primitive special case of the regression equation, and causation in terms of time sequence and correlation formulas.

Strauss and Werner (92), continuing their studies of brain-injured children among the mentally retarded by means of object and picture tests, found that the brain-injured selected more objects, showed more uncommon responses, seemed to depend on unusual, accidental, or apparently

insignificant details, and were attracted to items apt to elicit motor responses. In addition (108) they elaborated on details, changed the meanings of objects to suit their present associations, and passed far beyond the given situation in space and time. Their performance was erratic and uncontrolled because of their excessive fluidity of associations and their readiness for assimilating unrelated materials. When asked if various objects were living or dead, the brain-injured children were less able to differentiate between persons and things. They more often gave animistic responses, reasoned from human situations, and attributed conscious activity to objects (107).

Russell (80), in the fifth of a series of studies of animism, reported the results of giving a paper-and-pencil test to 611 pupils in Grades V to XII. Classification of the subjects into one or another stage of development on the basis of their written answers and reasons revealed that the percentage of cases in the adult stage increased with MA and CA and at the eighteen- to twenty-year level. Experiments dealing with children's ideas of causality showed that these ideas were determined by age, intelligence, and the cultural milieu and that they were more often naturalistic than animistic (38). A record for confusion in concepts, when they appeared in a verbalized ritual, was chalked up by Olander (65) in a study of the amazing interpretations of elementary- and high-school pupils of the salute to the flag. Hildreth (35) emphasized the importance of the so-called "difficulty reduction tendency." This is the tendency to interpret new concepts in terms of one's own limited experience, and is found, unfortunately, at all levels of mental maturity. This scheme for simplifying problems needs to be guarded against, since it accounts for many errors in thinking, by making sure that children are mature enough to comprehend the problems with which they are presented, and that adequate explanations are given.

Differences in adolescents' abilities in abstract and in critical thinking in practical behavior situations were found to be related, not to interests or emotional conflicts, but to the "purpose score," i.e., the presence or absence of a well-formed plan and an appreciation of careful work in reaching a goal (9). Attitudes toward conclusions reached were found to produce more errors in judgments of the logical validity of syllogisms when the subjects agreed with invalid and disagreed with valid conclusions than when they agreed with the valid and disagreed with the invalid (43). The conative aspect of thinking was developed by Wolters (109), and concepts elaborated by Head, Bartlett, and Wolters were critically examined by Oldfield and Zangwill (66).

Social Learning: Attitudes and Delinquency

Studies of learning in social situations dealt primarily with attitude changes and the treatment of delinquency. Newcomb (63) found that social attitudes moved to the less conservative side during college, but remained constant for several years thereafter. Little relationship was

found between attitude change and the course of study, and Hunter (40), reporting similar results, found there was no change in attitudes on religious questions. The influences of high-school instruction were likewise studied. Pupils in an eleventh grade who had taken science were found to be no more able to ignore their prejudices on certain controversial issues than pupils who had not been so instructed (27). But, after a course in principles of secondary education fifty college juniors showed a shift in attitude in the direction of the best educational opinion, particularly in the areas of the curriculum and formal discipline (76). The value of instruction, as such, is, however, called into question by a study in which pupils of liberal teachers tended to become more liberal, and of conservative teachers more conservative, the most influential teachers being those who rated themselves as believing most in the pupil's right to his own convictions (57).

Actual experience has been found to be effective in the modification of attitudes. Twenty-six members of a seminar on social problems, involving a week-end roundtable conference and a field trip thru eastern and southern states with supervised visits to various communities and progressive schools, showed an increase in liberalism over their controls, tho both groups had developed greater conservatism three years later (6). Attitudes of forty-six college students toward the Negro improved after they were exposed for four days to social and intellectual contacts with leaders of Negro Harlem (91). A gradually developing understanding of the democratic process was reported as one of the results of an attempt by adolescent girls in an institution to set up a system of self-government (44). Eighty-three delinquent eighth- to tenth-grade girls did not differ from their one hundred non-delinquent controls in attitude toward war, on the Thurstone scale, but showed a more favorable attitude toward Sunday observance and the Bible (59).

The influence of careful instructional technics has been studied. Prestige suggestion, in the fourth of a series of papers by Lewis (51), was found to be ineffective in changing the attitude toward political slogans, except when the purported ratings by either a popular or unpopular figure served to place the slogan in a new light. The most detailed instructional procedure was followed by Rhinehart (78) in a direct attempt to modify social behavior. The children of 500 families, enrolled in a five-year cooperative program to inculcate correct dietary and sleep habits, and provided with trained leadership in play and recreation, improved in dietary and sleep records, social development, character growth, emotional adjustment, and home attitudes. Categorizing social behavior as domination, cooperation, and nonassertion, Chittenden (16), using a doll-teaching technic found that dominating preschool children, unlike their controls, moved significantly toward the cooperative category. Camping over a two-weeks period resulted in reliable gains for the older boys on the Washburne Social Adjustment Inventory, while younger boys showed no changes

on the Rogers Test of Personality Adjustment; but on the latter instrument eighteen underprivileged boys showed a loss (33).

The roles of the central person or leader, around whom group formative processes take place productive of "group emotion," were identified by Redl (75) as the patriarchal sovereign, leader, tyrant, love object, object of aggressive drives, organizer, seducer, hero, bad influence, and good example. Mediocre leaders were retrained to become efficient democratic leaders by changing their attitudes and technics (3). The process of retraining an autocratic leader using role-playing as a method was described by French (24) with the use of case material. Some of the problems and technics of group therapy do not differ widely from many in the field of learning and teaching, as illustrated by Slavson (89), who indicated that the main task of group therapy is to overcome emotional "encapsulation," the resistance to the world and to the people who may have a helpful influence. The literature of group therapy was reviewed by Thomas (97).

The psychodrama, a new technic for acquiring an appreciation of social interrelationships, was shown by Lippitt (52) to be useful in leadership training, by Shoobs (88) to decrease truancy and other antisocial behavior, and by Zander and Lippitt (112) to inculcate performance skills and basic attitudes in addition to factual information. Its theoretical aspect as "role-taking" was analyzed by Sarbin (82), and was defined by Moreno (60) as deep action method dealing with interpersonal relations and private ideologies, in contrast with the "sociodrama" which deals with intergroup relations and collective ideologies.

Two reports on reeducating delinquents may perhaps be justifiably juxtaposed, one American and one British. In the American report (73) seventeen out of twenty-one institutions for delinquent boys used corporal punishment, fifteen reporting it as a substitute for psychological and psychiatric service which they would prefer but could not afford. According to the British report (49), youths treated under the Borstal system rated fourteen factors responsible for the benefits they had derived, placing the first four in the following order: the housemaster, the work, the officers, and the discipline.

In a five-year follow-up study it was found that those influences most evident in the causation of delinquency were also the most detrimental to the successful application of probation, e.g., defective home discipline, opposing temperamental traits, lack of definite interests, and unstable employment (39). Recidivism of ten- to twelve-year-old delinquents was reduced over a three-year period by helping each child to fulfil his needs in nondelinquent ways thru play materials, school placement, contact with a recreational center, part-time employment, and reeducation of parents (50). The fact that 61 percent of the first admissions and 78 percent of the recidivists showed truancy as the first offense was interpreted as evidence that failure to meet classroom standards of behavior in elementary schools, leading to truancy, is a cause of crime (45). To test this hypothesis,

Kvaraceus (47) compared a sample of 761 delinquents over a five-year period with nondelinquent controls with the following results (delinquents being mentioned first): IQ—89, 103; repeated one or more terms of school—44 percent, 17 percent; truant—34 percent, 6.8 percent. Sixty percent of the delinquents expressed dislike for school and its associations, and there was a marked falling off in delinquency when the schools closed for the summer.

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CHAPTER V

Auditory and Visual Education

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TWO SEPARATE chapters were given over to the consideration of teaching aids in the June 1942 issue of the REVIEW OF EDUCATIONAL RESEARCH. Chapter VI dealt with "Radio and Records in Education"; Chapter VIII summarized investigations concerned with "Visual Aids in Education." In light of the development of the field of instructional materials and equipment, such a separation now seems both artificial and undesirable.

The commonly used term "audio visual" shows that very often the two merge into a single teaching device. Records are used with slidefilms to make possible the sound slidefilm. The sound motion picture provides pictures and sound track on the same piece of film. Television, tho still largely undeveloped as an instructional medium, adds a visual aspect to radio.

Then, too, there is a large mass of instructional materials in which the appeal to the sense of touch is equal or greater than that of sight. Teaching aids of olfactory nature have been used in training air-raid wardens to recognize the smell of different poisonous gases, and the future may see the school making increased use of devices of this nature. Categorizing these types of instructional materials separately tends to make the teacher consider them as unrelated aids to instruction which are competing with each other for acceptance and wider use, a most undesirable concept of the philosophy of the field.

Research by the Armed Forces

It is probable that the most important research work in the field of instructional aids during the past triennium has been done by members of the armed forces. Certainly, the Army and Navy have extended the use of training aids further than any other organizations, and likely, an evaluation of the work done has been made. Unfortunately, however, there is practically nothing published in regard to such research.

It is not difficult to find an Army or Navy release (54) making such statements as "Tests show that students learn up to 35 percent more in a given time" when training aids are used; or that their use results in "facts learned are remembered up to 55 percent longer." But such bald statements are all that the reader is given. Just how it was discovered that trainees learned "35 percent more" is not stated. Whether the findings are based only upon an individual officer's opinion, or on carefully worked out evaluation studies cannot be ascertained now, because studies so far have not been reported in sufficient detail. It would be neither wise nor fair to judge the validity of the findings at the present time. It is to be hoped that a thoro evaluation program has been carried out by those in charge of the work. If such is the case, then the future development of teaching

aids and technics in their use should be directed to a considerable degree by the findings of the armed forces.

Noel (35) stated that a definite evaluation program is a reality in the Navy. "This work covers evaluation in its broad aspects and will be pertinent to production, distribution, utilization, and curriculum." He added that altho no announcements could be made then, "when the proper time arrives, educators will receive the information."

Lack of Significant and Pertinent Research

Altho the last three years have seen a tremendous increase in the interest of educators in teaching aids, especially visuals and FM broadcasting, neither the development of the field nor the use of materials in the schools has been extended. This fact is due in a very large measure to the war and the restricted manufacture of equipment for civilian use. Research in the field has reflected the status of the program in the schools. There has been no continuous pattern of investigation. For the most part, studies have dealt with specific problems in a rather superficial manner. It is not difficult to match every investigation that has proved that the use of visual or auditory aids resulted in increased instructional effectiveness with one that has shown no added benefits to pupils. And even on points where the results of research have been fairly consistent, study has not always been on currently vital problems.

One of the most apparent needs in the field is additional investigation of specific aids and the functions that each performs best. Clark (7) held the school excursion or field trip to be important in the development of interests, ideals, and appreciations in students, but of little value in the acquisition of factual knowledge. Cypher (9) concluded that the diorama was a valuable teaching aid with limited use at present but with a bright future. Goodman (15) in a comparison of motion pictures and slidefilms, both sound and silent, found the silent motion picture to be the most effective medium of the four in teaching a unit of work, and the sound motion picture the least valuable. These minor and limited studies only emphasize the need for additional investigation.

Availability of Equipment and Materials

Since 1941 there have been several surveys made to determine what equipment and materials were available to the teacher and their acceptance and use. Findings were drawn from visitations and questionnaires, and the scope of concern ranged from single cities to all the Latin American countries. Larson (28) on the basis of his investigations estimated that there were 15,000 sixteen millimeter projectors in the schools of this country. In cities of more than 100,000 population, he stated that 4.6 projectors were available per 100,000 population. Goodman (13, 16) reported on separate studies by Mears and McPherson. The former, he said, found few, if any, schools in Texas with sufficient access to films or visual aids equipment to maintain an effective visual instructional program. A study of California's school districts by the latter resulted in his recommenda-

tion for more centralized visual services, probably on a state support and service basis, because the rural schoolteacher was seen to have little chance for using visual aids. This same disparity between equipment in city and rural schools was found by Ritchie (40) in British Columbia. The suggested plan for increasing availability of material, however, was that of having several school districts pool their funds and share equipment and films.

McCarty (32) stated that 115,000 school children listened more or less regularly to the Wisconsin School of the Air broadcasts. Three thousand schools in the state were listed as listening schools, 62 percent of which were state graded schools. Gilburt (11) found, however, that in approximately six hundred elementary and eighty-two junior high schools in New York City radio had not yet been unveiled in spite of the fact that about 83 percent of all American homes have a radio. Chapman (6) surveyed the various state departments of instruction by questionnaire and learned that only three states have a full-time person responsible for educational broadcasts, and that only four states offer classroom broadcasts as a part of the program of the department of instruction. Ten of the thirty states that replied stated that they did nothing in the field of educational radio.

Several investigations published during the last three years treated the organization, equipment, and practices concerned with audio-visual education in the schools. Most of these studies gave no conclusions except as the presentation emphasized services and procedures that were found to be especially effective. Seaton (49) visited six representative cities and studied their programs intensively. Recommendations which she drew from these and other sources are commented upon in the concluding portion of this chapter. Molyneaux (34) gave a detailed account of current practices in audio-visual education in twelve school systems of the United States. Sechriest (50) studied the visual program in thirty-eight cities of between 100,000 and 500,000 population and found little supervision of this phase of the school system's program. Equipment was found to be varied in quantity, but limited in type. Atkinson (1, 2, 3, 4) reported on educational broadcasting by the major networks, public-school systems, and institutions of higher learning.

The status of visual equipment in the Latin American countries was considered by Golden (12), and a forecast was given of the future of the program. Stenius (52) visited ten European countries to investigate educational broadcasting and presented a comprehensive overview of conditions as they were immediately before the war. Gray (19) limited himself to consideration of the use that Germany, Italy, Japan, and Russia had made of the radio and motion picture as an educational force and suggested certain forward steps for increased use of these agencies of communication in this country. Several of his suggestions were similar to those made by the British Film Institute (53) to correct the six principal difficulties holding back the visual education program in Great Britain.

Effectiveness of Instructional Aids

In the June 1942 issue of the *REVIEW OF EDUCATIONAL RESEARCH*, Reid and Day (39) stated that studies concerned with a comparison of radio and nonradio learning were inconclusive. In the same issue, Kinder (27) reported that research had failed to give definite proof that learning with visual aids was more effective than without them. These two statements are still appropriate. Many additional studies were made during the last three years attempting to determine the effectiveness of auditory and visual aids, but still little significant progress can be observed.

The separate studies that have been made are, for the most part, inconsequential. Individuals have worked with groups too small for findings to be meaningful except in the specific situation concerned. Investigators have seemed more anxious to justify a belief of their own, to work along the line of a personal interest, or to limit experimentation so that it might fit within the framework of their local teaching situation, than to make a meaningful contribution to the research of the field.

Some of the best research studies published during the last three years were those presented by the staff of the Evaluation of School Broadcasts study at Ohio State University. A large portion of these reports which were published in 1942 were included by Reid and Day in their June 1942 chapter of the *REVIEW OF EDUCATIONAL RESEARCH* because the actual research had been completed and first drafts prepared in 1941.

Recordings and Transcriptions

Lowdermilk (31) used transcribed radio broadcasts and found that dramatic programs do affect social attitudes of student listeners, but that reading printed program adaptations also proved to be effective. Students appeared to regard materials presented over the loudspeaker somewhat less critically than they did the material they read. Miles (33) used supplementary recordings in science classes and learned that while interests in some aspects were heightened by the records, the students' breadth of interest was decreased. Students of Spanish showed definite increase in oral comprehension when recordings were used, according to Goudy (18), and transcriptions also proved to be a good stimulus to further study. The latter point was substantiated by Bathurst (5) and Hockman (24).

Studies made by Rulon (44, 45, 46, 47) resulted in findings opposite to those just mentioned. Recordings were found to be of little value in motivating students to further study, and failed to exhibit any superior effectiveness in the teaching of informational material. A slight shift in attitudes was achieved by the use of recordings, but the results were in no way conclusive. In general, Rulon's studies showed that there was no sound basis for the popular belief that today's radio-minded youth learn best thru the ear.

These investigations reported by Rulon were based on the reactions of several groups in different parts of the United States. The pattern used in determining the value of recordings alone in presenting factual ma-

terial serves adequately as an example of the method used. "The Sound of History—Then Came War: 1939" was the set of records listened to by those groups with whom an auditory experience was the basis for acquiring information. A playlet, developed from a typescript of the records and containing almost identical verbal content, was the reading material which other matched groups used for gaining their facts. The greatest difference between the recorded and written material was that sound effects were heard in the former and only called for in the latter.

Two groups of students in each of seventeen representative high schools thruout the country participated in the study. Equal time was given to listening and reading. Three parallel objective-type tests were used to determine the gain of factual information. The first test was given before the records were played or the material was read. The second test was given immediately after the listening and reading experiences; the third check was made a week later. Altho the three tests were not identical, they were of equal difficulty and scope. To validate this part of the testing program further, one-third of the pupils in all classes received each form at each one of the testing periods. Teachers participating in the investigation were given detailed instructions which left little or no room for individual interpretation. Instructions to students were read by the teachers.

The groups which studied the playlet showed statistically significant, immediate gains in factual knowledge. After a week's time, however, the superior gain was reduced practically to disappearance. Rulon ventured an opinion that if a fourth test had been given several weeks after the listening and reading experiences, the listening group might well have shown the greater retention of information.

Visual and Audio-Visual Aids

Findings of experimentation to determine the effectiveness of visual materials have been somewhat more consistent than those dealing with auditory aids, but results are in no way conclusive. Holland and McDaniel (25) in an experiment with Latin American students who were learning to read found that visuals permitted those experiencing them to excel a control group by about 20 percent in quickness and accuracy of word recognition and in constancy of progress. Lockhart (30) investigated the value of motion pictures in learning a motor skill and stated that they proved effective for such a purpose. Eight teachers working with slow learning pupils under the direction of Vauter (56) learned that hand-made slides permitted the less able students to score almost as high in subjectmatter and retention tests as high intelligence children did without the slides. When Schmidt (48), however, compared auditory and visual presentation of learning materials to a group of retarded readers, 33 percent of the pupils showed a decided preference for the auditory presentation, the preference being strongest with the slowest learners. Deaf children, Purdy (38) pointed out, received little from motion pictures unless they had a complete working vocabulary used in titles and were prepared to watch for certain items in the films.

Halbert (21) worked with three groups to study the value of illustrations in accompanying reading material. She found that reading a story with pictures gives a child a better concept of content than either reading a story or looking at pictures alone. For stimulating and arousing ideas not directed toward some specific goal, pictures alone were found superior.

Wittich (60) compared three methods of use of classroom films to determine which gave the greatest acquisition of factual knowledge and social understanding, and also to learn the extent to which intelligence and reading ability influence a child's ability to gain information from educational sound films. The first method had the children see the film after having anticipated the film only in the course of casual and organized classroom work, and immediately after seeing the film respond to a test. In the second method the pupils read a brief story-like setting about the film, studied words and phrases necessary to understand the sound track, read questions which anticipated the large areas of information in the film, and responded to a test immediately after seeing the film. The third method included all of the second and added, twenty-four hours later, oral discussion of a prearranged set of questions based on the film, rescreening the film, and taking the test a second time. The average time spent by groups in each of the three methods was thirty-five minutes under method one; forty-five minutes under method two; and ninety minutes under method three.

Wittich's conclusions were that the level of performance under method three was virtually double that resulting from the first method, and method number two showed approximately a 50 percent improvement over method one. Significant gains, however, resulted from all of the three methods. The more difficult the film, the more effective became methods two and three, and both high and low intelligence children were motivated similarly and in comparable amounts. Methods two and three also produced an increased homogeneity of performance. In general, the study proved the definite worth of using adequate anticipatory teaching technics with educational sound films.

In an attempt to investigate elements of films themselves, Goodman (17) stated that Sturmthal and Curtis studied the reactions of audiences and concluded that the visual elements of a sound motion picture are more important than the sound. Park (36) studied the vocabulary and comprehension difficulties of pupils with sound motion pictures and concluded that a class's interest in a film is closely related to the mean vocabulary of the film. Long sentences in the sound track resulted in a decrease of comprehension by the pupils.

One assumption and recommendation may be drawn with validity from the inconclusive findings which have been summarized in the last few paragraphs. Because instructional aids are tools to be used by the teacher, and not intended to do the instructional job by themselves, the teacher himself becomes a very large factor in any investigation of their values. When John Doe, therefore, uses certain films in teaching a unit of work,

he is apt to get different results than another using the same materials. Yet, the films are intended as a tool for the teacher to use, and determination of their effectiveness without a consideration of how he uses them is of little value. What appears to be needed is further study in which greater attention is given to the teacher as a variable factor.

Museum Materials

A phase of the instructional aids program which may develop to a considerable degree after the war is that often referred to as museum service. The armed forces have made much use of models, mock-ups, dioramas, and specimens. In most instances, visual education departments have not concerned themselves with these materials, but rather with projected visuals—motion pictures, slides, and slidefilms. In some cities, notably Detroit and St. Louis, flat pictures, models, and realia are furnished to the teacher by the school system's museum department. In many other cities materials of this nature are available to the teacher thru museums separate from the school system.

But the importance of museum service to the schools is not apparent if one judges on the research given over to this phase of the instructional aids program. One major investigation reported during the last three years was conducted in five cities—Buffalo, Chicago, Cleveland, Milwaukee, and New York—and was made possible thru a grant of funds from the General Education Board.

In reporting this study, Powel (37) explained that because the experiments differed in type in each of the five cities, no over-all statistical analysis could be worked out; but all collaborating schools and museums found that students benefited greatly from their introduction to museum materials. Several definite conclusions were reached thru the separate studies. Probably greatest stress was placed on the necessity of schools being built to use museum materials. Optimum benefits from exhibits, pictures, and displays cannot accrue unless a school has a special museum room or other adequate and correct exhibition facilities. Just adding a table or display case to the ordinary classroom or corridor does not make for effective exhibition of museum materials.

It was also recommended that in large city school systems, visual materials of the museum type should be furnished by the school system itself rather than to depend upon an outside organization or institution. With both museum and schools under a single administration, a more effective program is possible. Such an arrangement also permits purchases and services to be based entirely on school needs.

There was no claim to scientific accuracy in evaluating the project. The pattern of investigation used in Buffalo was that of having a teacher serve as attendant and make observations and timings of the responses of students to the exhibitions. In Chicago, teachers and principals were asked to make comments on the program and express their feelings on the value of the project. In Chicago, Cleveland, and New York, appraisal also was

based chiefly on reactions of museum staff members, teachers, and school administrators.

From evaluation technics such as those mentioned, several conclusions were reached. Students found three-dimensional objects somewhat less attractive than two-dimensional material. Pupils did not give enough time to exhibits to absorb the material presented. The means of presenting material was more important in getting attention than the kind of material itself. School museum visits should not exceed one hour. Schools should have picture frames which open at the back so that a variety of prints can be displayed.

Additional studies dealing with museum service which came to the author's attention were few. Only VanFleet's investigation (55) showing that the diorama possesses greater interest values than flat pictures, and Wall's survey (57) of lighting technics in museums of Europe and the United States, were found.

Out-of-school Radio and Motion Pictures

Altho one usually thinks of a school's visual and auditory education program as pertaining to classroom activities, there is little doubt that the greatest portion of a pupil's visual and radio "education" comes from his out-of-school seeing and listening. The movies and radio are tremendous educational forces and must be recognized as such by the teacher, whether their influence, in his opinion, is good or bad.

Weil (58) studied the listening patterns of 422 high-school boys and found that their listening preferences followed the same pattern as that shown by surveys of adults. If one may reason that the teachers of these boys are a true sample of the adult listening pattern, then the students listen to much the same programs as their teachers. That such a conclusion may have a valid basis can be argued from Robbins' investigation (41), which did not show too great a disparity between teachers and a general sampling of adult listeners. Witty and Coomer (61) checked on both the radio-listening and the motion-picture experience of high-school students and held that the effect that these two media of expression have on today's youth makes guidance of the pupil's leisure-time activities one of the most important responsibilities of the teacher. Looking at radio's influence on youth's attitudes, Rowland (42, 43) found that radio is responsible to the same extent that other channels of communication are. but that radio promises more because it is less firmly entrenched in tradition and a way of doing things.

Gundlach (20) reported that there was only a slight relationship between the popularity of a radio program and children's ability to identify the sponsor, a finding that may tend to allay the fears of some teachers who hesitate to assign "listening" homework because of a program's commercial sponsorship. Children seem able to shed propaganda better than one may think. Programs on the comprehension and interest levels of younger children are scarce, however, according to Crosby (8), and with

rare exceptions their school use is inadvisable on the early elementary level. Erickson (10) held that in-school listening to standard programs was more effective than home listening, but Stadtlander (51) pointed out that pupils could improve their ability to listen when proper help was given them.

Suggestions for Development and Study

Altho the war has retarded the growth of the instructional aids program in the schools, during the last three years educators have shown a heightened interest in the effectiveness gained by use of teaching devices. As might be expected, therefore, much work has gone into planning the school's postwar, audio-visual program. The most intensive examination of future needs was that of the American Council on Education reported by Seaton (49). Altho a study of only six cities acted as a basis for the report, recommendations from a committee of educators in the armed forces and previous investigations of the council were added to Seaton's personal evaluations to set up standards. Tho many may on first thought express the belief that the report suggests an idealistic program (a full-time, audio-visual specialist for every county of more than 25,000 population; a sound motion-picture projector for every two hundred pupils, etc.), study shows the report to be entirely realistic in terms of a functioning and meaningful program.

Hoban (23) summarized work done under the General Education Board's motion-picture project, and tho previous publications have given much of the material reported on, the book is an excellent integrated treatment of the various studies. Admitting that the report was more a discussion of what can be done than of what actually is being done, Hoban concluded that the use of motion pictures in education had hardly been scratched.

Just what motion pictures and other types of instructional aids can do makes a fine area for further study. Goodman's report (14) on O'Conner's investigation stated that sound motion-picture films amount to little more than silent films with lectures. In the films studied, 41 percent of the footage was wasted as far as motion utility was concerned. The material might have been presented on slides as effectively. The inherent element of action that motion pictures possess was not utilized in much more than half the film. Goodman's own study (15) showed the advisability of additional work to determine what contributions sound motion pictures can make that are not offered by other media.

The necessity for making special transcriptions for the classroom was stated by Hood (26). He pointed out that the broad objectives and general audience bias of broadcast programs do not make them wholly suitable for school use. Even programs broadcast especially for schoolroom use were failing to achieve eighteen important objectives according to teachers in Chicago, Detroit, and New York, who were questioned by Woelfel (62). Goudy (18) argued against the reproduction of radio programs on regular phonograph records, because the five breaks necessary to get the usual

half-hour program on twelve-inch discs prevent dramatic build-up and destroy continuity.

The development of FM broadcasting and the planned increase in the number of stations owned and operated by educational agencies promises much. Even tho the schools will have objectives different from those of commercial radio, educators will do well to study how the networks have attempted to judge the nature of the different listening audiences and the effectiveness of programs. Hill (22) gave an excellent overview and appraisal of educational programs for the general listening public which may act as models for educators. Lazarfeld and Stanton's book (29) was concerned primarily with the commercial field, but the gathered reports have valuable implications for those educators who will shortly find themselves in the broadcasting business. The "program analyzer," which was invented by Lazarfeld and Stanton and which was tried by Wiebe (59) on educational programs, is a mechanism and method that seems to have less possibilities for schools for determining the strengths and weaknesses of a program before it is broadcast than such methods as Stenius (52) reported findings in Italy and Switzerland. Before the war, all radio programs intended for use in Italian classrooms were presented over a public address system in a single experimental school and checked for effectiveness; while in Switzerland a multimembered committee received a special "wire" broadcast of programs before they were finally aired for school use.

Conclusion

It is likely that there will be a considerable amount of research in the area of instructional aids in the immediate future. The interest now evidenced in the development of the field will probably crystallize into a desire to understand better the specific job or jobs that each type of aid can do best, and how it may be used most effectively. Seldom-found equipment such as the micro-projector and commonplace devices such as the globe should, and most likely will, share investigation with the motion picture and recordings.

The time has come when we may accept such principles as any teaching aid is more effective when a child is properly introduced to it, and when the teacher does not conclude the "lesson" with turning off the projector or radio. Study on a point of this nature amounts to an investigation of whether an instructional aid is more or less valuable when properly used. Perhaps more profit will accrue if we accept the findings on such points as conclusive and give our time and effort to studying other problems of greater import.

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CHAPTER VI

The Library in Education

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PART TWO of the Forty-Second Yearbook of the National Society for the Study of Education, entitled *The Library in General Education*, is a comprehensive and thoroughgoing analysis of the school library field. In that volume school librarianship was subdivided into seven areas: The Library as a Vital Agency in Education; The Library in Action; The School Personnel and Library Service; The Nature and Selection of Materials; Machinery for Implementing Library Service; Preparation of the Staff for Effective Service; and Evaluation and Research. Altho not the result of original investigation, this material shows careful study and analysis and presents the expert opinion and the experience of the investigators and writers who contributed to the volume.

The American Library Association, in conjunction with the Carnegie Corporation, sponsored a quick study of the changes induced by the war in schools and school libraries. Butler (6, 7, 8, 9) compiled returns from questionnaires and summarized results in articles that appeared in various professional periodicals. Her findings are provocative and have inspired school librarians and administrators to institute changes in library procedures to meet presentday needs.

Research in Librarianship: Bibliographies

Few bibliographies listing studies in the field of library research exclusively have been published during the past three years. Kirk (29) listed twenty-four masters' theses as well as bulletins and articles dealing with problems of book supply in school libraries. The list is suggestive of further studies which might be undertaken. Gray (21) in his "Summary of Reading Investigations, July 1, 1942 to June 30, 1943," listed studies made on all phases of the reading problem. The summaries of the investigations devoted to the reading interests of children and young people are of particular interest to librarians.

Fay (19) listed the areas in which sixty or more investigations have been made by students in their graduate studies since the master of science curriculum was begun in the School of Library Service at Columbia University in 1928. The author summarized in some detail studies in two major fields of college library administration: (a) the book collection in relation to the curriculum and (b) the adequacy of book reviewing in subject journals. for college library book selection. The bibliography listed thirty-one studies made in these two areas.

Library Administration

Several studies have been made relating to the external control and administration of libraries. Stallman and others (43) listed administrative controls of school libraries according to: (a) the board of education; (b) the public library; and (c) both the board of education and the public library cooperatively. She found that 96.5 percent of all school libraries reporting were controlled by a schoolboard; 1 percent by a public library board; and the remaining 2.5 percent by a cooperative arrangement.

In a study of public library service to public-school children, Stallman (42) indicated patterns of administrative organization of libraries and types of services to children. She undertook the investigation with two major assumptions: that library service meant provision at the main library or at any of its agencies for books, reading guidance, and reference assistance for pupils or teachers; and that, in addition, it meant any special provision within the school for guidance or assistance in the use and distribution of books which are neither textbooks nor school-provided sets of supplementary texts. Data were obtained from forty-two library systems in cities of 200,000 or more population. Included in her findings were the following: (a) Only a small minority of the forty-two public libraries investigated supervised school library branches; in other words, public-school systems administered a very substantial majority of the school libraries in major American cities. (b) Complete statistics of total library service and expenditures for public-school children were obtainable in a great majority of cities only by adding statistics of public library and school library services and expenditures. (c) A steady evolution in the form and quality of public library service to schools is clearly evident, from classroom library to centralized deposits to full-fledged school libraries. (d) The ultimate development of public library service to young people is the complete school library designed for service to school children only.

Proof of the growing importance of the elementary-school library is seen in the study made by Brown (5) of the methods and practices in supplying library service to elementary schools in the United States. The author stated that his purpose was to determine: (a) the methods which were used as the principal means of supplying library service to public elementary schools in cities in the United States with a total population of 10,000 or over; (b) the extent to which these methods were used in geographic sections and thruout the country as a whole; (c) the methods which were used as supplementary or additional means of supplying library service; and (d) the extent to which certain public elementary-school library practices were used.

Ellsworth (17) presented facts concerning trends in book expenditures in fifty-three of the most important universities for the past twenty years. He found that since the depression university library expenditures for books

have not kept pace with the increase in expenditures for educational purposes generally. Small universities have increased their rate of book expenditures faster than medium-sized universities; medium-sized universities, faster than large universities. His investigation led him to conclude, also, that important facts and figures of American universities are not properly collected.

Reagan (35, 36) conducted two studies on the college library exhibit, one based on the literature in the field, the other relating to the use of the college library exhibit. Returns from fifty liberal arts colleges were tabulated. The author found that the typical library exhibit was not used in the "integration of the library program with the instructional program" but rather to show "the independent resources of the library for self-cultivation."

Brown (4) studied conditions governing the service of student library assistants in six college libraries for the purpose of ascertaining the qualifications required, the work performed, and the cost of such service. The author recommended the introduction of personnel management methods in the appointment and supervision of library assistants.

The Book Collection

A number of important studies have been made relative to the adequacy of the college library book collection. Several of them were listed in the summary made by Fay (19) to which reference has already been made in this chapter. Gosnell (20) studied the problem of the obsolescence of books in college libraries. His purpose was two-fold: (a) to obtain a more precise basis for the comparison of libraries with regard to obsolescence; and (b) to present, by the quantitative analysis of three lists of recommended books and by an analysis of library collections, a clearer picture of obsolescence than had been previously available. The rate of obsolescence was computed for nineteen subject fields in the three lists; however, the coefficients of obsolescence were not final. They must be standardized by application to large groups of libraries. Included in a comprehensive list of results and conclusions were the following: (a) the average life of a book is about twenty years; (b) in many college libraries, however, titles over thirty years' old comprise at least half the collection, but less than 10 percent of the books are in active demand; and (c) 60 percent of the collection may account for 90 to 95 percent of the circulation.

Stieg (46) sought a technic for evaluating the college library book collection which would be more objective than a check of the collection against standardized lists. He assumed that important deductions could be made by securing information in regard to the relative frequency of the circulation of books and the proportion of the total collection used by the faculty and the students. He found: (a) that three-fourths of the titles withdrawn by faculty and students circulated only once during the academic year; (b) that during the three years of the study there was a

"steady year-to-year demand" for only a small proportion of all the titles withdrawn; and (c) that the great majority of titles which circulated more than once were recent books. The author stated that, since the study included data from only one college, library norms and standards relative to the findings could not be established.

On the assumption that faculties of colleges often depend upon reviews in professional journals to aid them in the selection of books for the college library, Steele (45) attempted to evaluate such reviews in terms of their strength or weakness when used for book selection purposes. Text-book analysis was used as a basis for developing a score card to be used in evaluating book reviews. Conclusions showed that reviews in educational journals of books on higher education furnished the librarian with sufficient bibliographical information but were not adequate for purposes of book selection for the college library.

Library Routine

One of the recent developments in the library field has been the careful study of certain time-honored routines. A motion and time study was carried on by Battles and others (3) on one item of library routine, namely, loaning a book. A one-card circulation system was used in the library where the study was made. Every operation was analyzed and photographed. The authors recommended: (a) great simplification of each step in the process of charging a book; and (b) reorganization of the books in the stacks to expedite their handling by the staff. The results indicated that similar analysis might be applied with profit to many other library routine procedures.

In an attempt to discover the relation between production and labor cost in the catalog department of a small college library, Knapp (30) kept records of the work produced and of the number and the cost of the hours of labor during the school year 1941-42. Her figures might be useful for other libraries in budgeting, but they offer no suggestions for improving the efficiency of the procedure.

Reading Guidance

No other field of investigation related to libraries claims greater attention on the part of educators and librarians than the field of reading interests and reading guidance. In a synthesis of research on the placement of reading materials in secondary-school literature, Painter (33) summarized available studies on children's reading interests, Grades VII to XII. Among the conclusions formulated were: (a) reading was a major leisure-time activity of girls and boys; (b) tastes changed with age; (c) children read much excellent material and much which is "worthless but harmless"; (d) inability to understand was the reason given most often for disliking books; and (e) the library was the chief source of reading material. These conclusions bear out the findings of other studies made in the past.

In a carefully organized study, Strang (47) used a combination of objective test, controlled interview, and free introspection to secure data on the interests and the response to reading materials of 112 persons from thirteen to fifty years of age. The results represented a cross section of reading ability and interest at the time of the test. The author reported in her summary that so many elements influenced reading interests that any attempt to study types was likely to be unrewarding; that what people read was dictated by their experience and their emotions; and that an apparent relationship existed between a subject's interest in an article, his estimate of its difficulty, and his proficiency in reading it.

Two studies of the reading habits of the exceptional child were made. Schmidt (38) collected information relative to the reasons for the choice of books within a group of 116 mentally retarded girls whose ages and intelligence quotients ranged from thirteen to eighteen and thirty-eight to sixty-nine respectively. Reading habits were found to be similar to those of the average child, altho preference for "readers" over other kinds of books was marked. Thirty-three percent reported that they selected books because of interesting titles; 25 percent, because of pictures. Fourteen percent chose books because they were recommended by other girls; while 9 percent chose books because of teachers' recommendations. Further study with larger groups of girls might give different results.

Polmantier and Gibson (34) reported the book and magazine preferences of 258 delinquent boys ranging from ten to nineteen years of age. They found that the interests of this group differed little from those of average boys in the same age level, and concluded that there was little evidence of the need for specialized books and magazines for delinquent boys.

Eells (15) surveyed the magazine preferences of more than 13,000 students in fifty-five junior colleges. He reported that students read fairly regularly an average of almost one daily paper and two and a half magazines each. *Reader's Digest* and *Life* were the two magazines read most frequently. His findings bear out other investigations in the field but have added significance because of the sampling.

One of the pioneer attempts to evaluate the effects of reading upon the attitudes of young people was made by Jackson (24). The author investigated the effects of reading fiction upon the attitudes toward the Negro race of a group of Southern white children in Atlanta, Georgia. The results showed a small but significant shift from a less to a more favorable attitude in the experimental group. The shift, however, was not lasting. The findings are in accord with what is known of the influence of reading upon attitudes. Jackson recommended that librarians buy and promote fiction in which the Negro is presented in a natural, favorable light.

The problem of the comics continues to challenge the best efforts of investigators. Witty and Coomer (50) conducted a study of the reading of comics at the high-school level and then compared their findings with those made in previous studies at lower grade levels. They found that high-school pupils reported greater interest in the comic strip than in the

comic magazine. Eighteen was the average number read. The median number of comics read by high-school pupils was distinctly lower than the number read in the junior high or elementary school. The comics, nevertheless, tended to hold high popularity at the high-school level and constituted at least one-fourth of the total magazines read. The authors recommended that intelligent direction in the reading of comics be given in schools, and added that the solution to the problem of the comics is to substitute good literature rich in action, adventure, surprise, and excitement.

Teaching the Use of Books and Libraries

The past few years have seen the publication of several excellent library texts and manuals dealing exclusively with book and library skills. In addition, a new emphasis is noted in current educational literature in the teaching of specific skills in the use of books and libraries. Units of instruction appear in many general textbooks in English and social studies. The need for teachers skilful in giving such instruction is apparent, and this has prompted some research during the past three years.

Henne and Lowell (23) restricted their investigation to procedures relating to the training of secondary-school teachers in book skills. The study was made on the assumption that knowledge of children's literature and of materials helpful in teaching should be a primary concern of the teacher-preparation program. Returns came from 153 teacher-training institutions in answer to a questionnaire designed to get information on the following factors: (a) the type of teacher-training institution; (b) the ways in which schools carried on instruction in the use of book and nonbook materials; and (c) the relationship of the laboratory-school library to this instruction. She found that 89.3 percent of the seventy-five laboratory schools having secondary grades were equipped with libraries. Book supplies in those libraries were fairly limited, with 58.2 percent of the libraries having fewer than 5000 books. Fifty and seven-tenths percent of the laboratory-school libraries listing more than 5000 titles had but one librarian. Forty and six-tenths percent of the institutions studied offered formal courses related to the use of library materials in teaching. Both teachers and students agreed that such courses were valuable.

To test the ability of college students to use library facilities, Reed (37) collected data from a large number of college students on the basis of the Test on the Use of the Library for Colleges. Student performance on the test showed specific weaknesses which should be considered by colleges in planning for effective reference service. The findings were as follows: (a) students had not acquired specific knowledge of reference tools; (b) students had not learned to associate questions with books likely to answer their questions; (c) students had not learned to use parts of books effectively and had inadequate knowledge of bibliographical features; and (d) students were not able to evaluate sources of information readily, nor did they understand the functions of various library departments.

In the area of a specialized technic in library usage, a study was made by Miller (32) on the use of the card catalog. Eight hundred seventy patrons in a college library were interviewed in an effort to measure the actual use made of information presented on the catalog card. Fifty-two percent used the catalog as a device for locating books. Forty-one percent used it to select books on a given subject. Seven percent used it to obtain bibliographical data. Further investigation as to the usefulness of information on catalog cards was suggested.

Library Service

One of the important sections in the Forty-Second Yearbook of the National Society for the Study of Education, Part Two, *The Library in General Education*, is Section XI, The Library in Action, in which Kennedy, Johnson, and Witmer described library service at the elementary, high-school, and junior-college level. Witmer (49) presented an anecdotal record of five libraries in diverse regions selected because of the excellence of their library service. The following aspects of service were emphasized: (a) the plans of librarians and teachers for library use; (b) the contribution of the library to pupil growth; and (c) the impact of the school's philosophy upon the library. The author concluded that the school libraries described were active teaching and learning centers, effective agencies for helping young people participate in democratic living, and thereby were aiding directly in the attainment of school objectives.

Johnson (27) described library service in five junior colleges selected upon the advice of the Advisory Group on Junior-College Libraries, a group financed by the Carnegie Corporation of New York. Over a period of two and a half years, this group surveyed junior-college libraries as a basis for giving grants by the corporation for the purchase of books. The survey included facts related to administration and practice, faculty cooperation, book selection, and the library as a unified part of the instructional program. Conclusions emphasized the following trends in junior-college library programs: (a) the adaptation of the library to the needs of individual pupils and teachers; (b) the recognition of the importance of factual studies as a basis for attacking library problems; (c) the extension of library materials to include nonbook materials; and (d) the role of the library in the college guidance program.

Erlandson (18) attempted to analyze the work of the information desk at the University of Illinois. Her purposes were: (a) to determine the qualifications of library assistants at that desk; and (b) to implement the materials for inclusion in a library handbook for student use. The author's findings indicated the importance of at least one year of professional library training for library assistants and showed the necessity for approachableness and professional attitudes. Erlandson also concluded that a handbook was useful as a general tool in explaining the use of the library but could not take the place of an information service conveniently located and attended by a trained librarian.

By a quick survey Johnson (26) brought together facts concerning the relation of college libraries to the instructional use of audio-visual aids. From 398 replies received, Johnson made the following conclusions and recommendations: (a) the colleges cooperating in the study made consistent use of motion pictures and recordings as aids to teaching; (b) few college libraries served as the centralizing agencies for audio-visual aids altho there is a pronounced trend toward such service; and (c) library schools must soon recognize that training in the administration of audio-visual aids is an important part of their curriculum.

Library Surveys, Standards, and Evaluation

Surveys, standards, and evaluation of library service are closely related areas in the library field. Surveys have been made as a basis for formulating standards as well as for ascertaining how these standards have been met. Evaluation follows after library service has been measured in terms of existing standards.

Recent surveys have included library service at three levels: elementary, high-school, and college. Hefin (22) examined state standards for elementary-school libraries in seven states having state school library advisers. The states included were Georgia, Illinois, Indiana, Louisiana, New York, North Carolina, and Tennessee. School libraries were compared on the basis of standards set for the number of books per pupil, number of subscriptions to magazines and newspapers, appropriations per pupil, professional books for teachers, organization and records, housing, lessons in the use of the library, and training of librarians. It was found that state standards were suggestive rather than mandatory. North Carolina has been a pioneer in establishing standards for elementary-school libraries, and her standards are more closely checked and more carefully tabulated than those in the other states which were studied.

The high-school library survey undertaken by Clevenger (12) was authorized by the Commission on Secondary Schools of the North Central Association of Colleges and Secondary Schools and was planned by the administrative committee. The general purpose of the study was: (a) to secure information on existing conditions; (b) to focus attention of local and state school authorities on high-school libraries and library service with a view of bringing about continued improvement; and (c) to make this information available to local and state high-school authorities for purposes of comparison. Statistical summaries were made in each of twenty states and included data on a large number of items, such as the preparation and teaching experience of librarians; the proportion of the school enrolment to the seating capacity of the library; the facilities and equipment; the library's income and expenditures; the ways of extending the effectiveness of library service; the cooperative use of the public library; and the amount spent for books. Clevenger found that most of the librarians held A.B. degrees; many, M.A. degrees; but few, Library Science degrees.

Many librarians had fewer than eight hours of professional library training. The proportion of school enrolment accommodated at one time in the library varied inversely with the number of pupils enrolled in the school. Wide variation was found on all points studied.

The North Central Association's 1943 survey of college and university libraries was undertaken as a part of the association's program for the evaluation and accrediting of schools. In 1943 all member institutions were asked for reports on their library resources and holdings. Data were sought on four specific items: (a) the quality of the book collection with reference to the academic program; (b) the adequacy of periodicals currently received in the library; (c) the expenditures for the library; and (d) the use of library collections. McEwen (31) explained in detail the check-lists used for obtaining data, described procedures, and concluded that clear, dependable measures of the use made of college libraries do not exist.

The high-school librarians of Memphis, Tennessee, (40) made a unique investigation of their school library facilities which might well be followed by other school systems interested in comparing their libraries with established standards.

Continued attempts at evaluation have followed the Cooperative Study of Secondary School Standards. Spain (41) analyzed present standards in operation by regional and state agencies for accrediting the work of the school library at the elementary, secondary, and junior-college level. Tables listing these standards were concerned with such items as the librarian, books and periodicals, appropriation, room and equipment, and organization. Advances made by school libraries complying with these standards were marked.

Because of the constantly growing demands of school libraries, administrators, teachers, and librarians must be alert to changing school objectives and procedures. A subcommittee of the American Library Association's Committee on Post-War Planning (1) has prepared a summary of standards that may serve as a guide in appraising school libraries of the future. The standards formulated deal with personnel, book collection, service to pupils and teachers, housing, administration, and extension. Recommendations suggest an increase of library service by an enlargement of the staff, increased book and nonbook materials, adequate library rooms properly equipped, and a library program which encourages the use of library materials.

Needed Research

The significance of the school library depends upon three factors of primary importance: (a) its role as a contributing source to the curriculum; (b) its position as a learning center in the school, a place where ideas are generated and knowledge is unified and integrated; and (c) its function as a dynamic force in promoting the intellectual growth of the individual. The library must be evaluated in these terms.

Carnovsky (10) cited the need for further study in the following areas: government and administrative authority; internal management; and the use of the library. Some of the studies proposed were: (a) the most advantageous extension of library service; (b) the achievement of basic objectives under different types of organization; (c) the application of existing standards to existing institutions; (d) the relationship between a child's intellectual development and his reading; (e) an analysis of books and of nonbook materials in the library; and (f) the competence of children and adolescents in using the library. These are some of the problems which must be faced in the future. The school library needs the help of research to face these problems. School library research, functioning ideally, should, first, measure contemporary conditions and, second, devise methods by which the natural and necessary growth may take place.

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INTRODUCTION

THE manuscripts that have been submitted for this issue of the REVIEW exhibit two outstanding facts relating to research in science and mathematics during the past three years. The first of these relates to the total amount of research reported during this three-year period as compared with that of the three years ending in 1942. When the bibliographies for the seven chapters of this report are compared with those for the corresponding topics in the 1942 REVIEW, it will be seen that the total number of references for the 1942 issue was 402, as compared with 241 for the present issue. This fact would be disturbing were it not for the many disruptions caused by the war.

A second and more hopeful fact, which has been pointed out by several of the contributors to this issue, is that while the total number of studies is less than that of three years ago, there are more truly excellent studies represented in the present bibliographies. If the appearance of these excellent studies is an indication of the maturity of the scientific study of educational problems, this is promising indeed. Perhaps even the paper shortage may be contributing something of value in making it impossible to print some of the more trivial studies which scarcely deserve classification as research.

As will be seen from the table of contents, the committee in charge of this issue of the REVIEW has purposely followed the main classifications used in the 1942 number. This is due, in part, to the committee's opinion that the 1942 issue gave an effective treatment to the material, and partly to the fact that following a similar organization facilitates reference from one report to the other.

The committee is indebted to three contributors who were not members of the committee, but who assisted in the preparation of material. Charles C. Weidemann, who was originally a member of the present committee, asked to be relieved on account of ill health, and his withdrawal was accepted with regret.

The authors of the various chapters have aimed to be selective in their choice of materials rather than to include all published studies bearing on their topics. Even so, there will appear some references which, in the minds of certain readers, may seem to be out of place in a review of research. In some cases these questionable studies are included because they carry the implications of other research or give mature, critical evaluations of research; and in other cases, as certain courses of study, because they reflect rather well the extent to which scientific research has affected the organization of teaching materials. Practically all of the references included are of American origin. Under the conditions of war, no review of foreign research was feasible.

G. T. BUSWELL, *Chairman*
Committee on the Natural Sciences and Mathematics

CHAPTER I

Teaching of Science in Grades I thru VI

FRANCIS D. CURTIS

ONE who surveys the published research in the teaching of science in the elementary school published during 1942-44, can scarcely fail to be impressed with the exceptionally small number of reports of investigations as compared with the output in previous equal periods; and with the unusually large proportion among these of major contributions. Of interest, also, is the fact that a majority of the published studies under consideration are learning studies.

The Nature of Children's Explanation of Phenomena

The value of challenging and testing, thru research, results announced by earlier investigators is shown in a study by Oakes (6) which puts in question several theses previously announced by Piaget, and now widely accepted. Oakes (a) analyzed the nature of children's explanations of various natural phenomena, presented as simple experiments or as verbal questions, (b) compared these explanations with those given for the same experiments by adults, and (c) analyzed the responses as to types of explanations. He wished especially to study the extent to which children use animistic, mysterious, magical, or other nonphysical ideas to account for natural phenomena.

To 77 kindergartners, 24 other children from each of Grades II and IV, 28 children from Grade VI, and 35 teachers of nonscience subjects in a liberal arts college, the investigator presented fifteen problems as verbal questions and seventeen as simple demonstration experiments. The subjects were interviewed individually in a separate room, the experimenter making notes of their responses. He later categorized these responses in various subdivisions under the headings physical (materialistic), non-physical (nonmaterialistic), and failure to explain.

Of major importance was the finding that most of the responses were naturalistic, a result at variance with certain theses of Piaget. The experimenter found, moreover, no evidence to corroborate Piaget's contention that there are definite stages in children's thinking which are characteristic of any given age. The differences between the responses of the children and those of the adults were found to be chiefly quantitative.

An important implication of this study is the practicability of and the need for training children from the beginnings of their schooling to seek naturalistic explanations of the phenomena they observe.

Children's Ability To Interpret Experiments in Terms of Generalizations

Baker (1) reported an extensive study to determine (a) the ability of children in Grades III, IV, V, and VI to interpret experiments in physical science correctly; (b) their ability to formulate generalizations; (c) the differences in their interpretations due to differences in mental age; (d) sex differences in ability to interpret such experiments; and (e) the factors affecting interpretation. The investigator demonstrated before each class separately fourteen experiments which together illustrated six different scientific principles. The 201 children individually wrote answers to the question, "What happened and why did it happen?"

From his results Baker concluded that children of both sexes are equally able to interpret such experiments; that this ability increases with mental age; and that the success in interpreting demonstrations depends upon such factors as kinds of apparatus used, order in which the experiments are presented, and familiarity with related phenomena.

Probably of chief importance in this study is the evidence which justifies the conclusion that children in the grades can formulate generalizations, or principles, from observations. This conclusion corroborates that arrived at earlier by Haupt and Croxton and adds corroboration of the practicability of the programs advocated in the *Thirty-first Yearbook of the National Society for the Study of Education* and in *Science in General Education*. An important implication is the responsibility of the teacher to make herself competent to direct the elementary-science experiences toward developing skills in observing phenomena and in formulating scientific generalizations.

The Sources of Information Used by Children in Solving Problems

An important contribution is the careful and extensive study by Bergen (2) to determine (a) what sources of information children tend to use or to suggest in attempting to solve problems; (b) what is the effect of the teacher upon children's selections of sources of information; (c) what sex differences are evident in such activities; and (d) what is the relationship between the kinds of sources which children suggest and the difficulty of the problem.

The investigator made running records of the classroom discussions of regular science lessons in five third-grade classes in two schools. She followed these observations with interviews with these children, and as a basis for comparison, with children of Grades I, III, and IV from a school where no regular science was taught. In these interviews she used questions designed to reveal how the children would and did find out. She analyzed responses to 199 problems.

The findings indicated that the children employed both empirical and authoritarian sources of information, chiefly books, and that the sources suggested for the more difficult problems were likely to be authoritarian.

The suitability and accessibility of the sources influenced the responses. The influence of the teacher was evident. The responses by the two sexes were not characteristically different.

The investigator points out the desirability of the teachers' making the children aware of their abilities and limitations, as a means of helping them to learn to choose appropriate sources of facts to solve their problems. Also, she emphasizes the great importance of the teachers' being alert to provide opportunities for the children to solve problems empirically. She stressed, as did Oakes (6) and as did Craig and Robertson, earlier, the need for elementary teachers to be better trained in the subjectmatter of the physical and biological sciences.

Difficulties Encountered by Teachers of Elementary Science

Quaintance (7) reported a questionnaire study of the problems encountered by teachers in carrying out a statewide program of elementary science. Many difficulties were listed by the approximately five hundred respondents. These indicate unmistakably that the teachers as a group lacked the necessary subjectmatter preparation to conduct the course successfully or with satisfaction to themselves. Most of the difficulties which they reported would not have arisen if they had possessed an adequate command of the physical and biological materials appropriate to elementary science.

Study Methods

Krause (5) reported an "equivalent groups" study with fifth-grade classes, to determine the effectiveness of having children write out answers to questions, as compared with having them formulate a new type test covering the same subjectmatter. Since the statistical treatment of the data could scarcely be deemed adequate, the chief value of the study would seem to lie in the emphasis it gives to the advantages to be gained from adding a new study device, such as test-making by the children, to procedures already employed.

Course Materials

Gilbert (4) reported an analysis of the topical content of seventeen state and thirteen city courses of study for elementary science, which is similar to the study of thirty-six courses of elementary science and nature study reported by Hillman in 1924. The investigator found, as had Hillman, a lack of agreement with respect to the science topics that should be studied, and with respect, also to the grade placements of the various topics.

The significance of any study of modern course content in elementary science in terms of topics may be questioned since the important developments in this field lie in the direction of effecting understandings of principles, developing scientific attitudes, and encouraging reflective thinking thru problem solving.

A monumental study by Curtis (3) indicated in elaborate detail the science known and practiced by a certain tribe of Indians. Unfortunately the extensiveness of the data probably will prohibit their publication. The study should nevertheless, exert a salutary influence toward encouraging the study of Indian life in all sections of the country as a source of elementary-science activities.

Concluding Comments

Summarizing statements cannot readily be formulated from the study of so small a group of investigations. One however seems justified: there is cumulative evidence of the need for broader training of elementary teachers in the physical and biological sciences as a basic essential to a successful elementary-science program.

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CHAPTER II

Teaching of Mathematics in Grades I thru VI

WILLIAM A. BROWNELL

FOR the three-year period 1939-1942 a total of 142 research reports and critical articles relating to arithmetic in Grades I-VI were summarized in the October 1942 issue of the *REVIEW OF EDUCATIONAL RESEARCH* (10). The corresponding total for the past three-year period is eighty-two. This latter figure is to be compared with the total of forty-nine studies listed by Buswell for approximately the same period in his three more rigorously selected annual bibliographies (13). The discrepancy is explained by the fact that in the present summary a larger number of articles of a theoretical and practical nature are included because of their value for stimulating new research and for improving classroom instruction.

COURSES OF STUDY

According to the *Education Index* five states published new courses of study in arithmetic. These were: Florida (21), Idaho (30), Kansas (36), New Mexico (45), and Vermont (68).

The Chicago city course of study, which received considerable publicity at the time of its appearance because of its frank espousal of a rather extreme stepped-up curriculum, was the object of both favorable and unfavorable criticism. Johnson (34), who was largely responsible for the course of study, presented evidence in the form of test data obtained in 1938, 1939, and 1940, to show steady improvement in learning under the new course of study. Chandler (16), on the other hand, noted numerous shortcomings in the course of study. Among them were the need for suggestions for enrichment and for guides to teachers, the need for less emphasis upon abstract computation and for more emphasis upon meaningful approaches, a reconsideration of the placement of topics grade by grade, and lack of agreement with adopted textbook series.

HISTORICAL STUDIES

Sueltz (62) observed that Adams, in his *Scholar's Arithmetic* published 125 years ago, addressed the learner in terms much like those used today, urging him to understand everything as he went along and to do everything possible for himself. Willey (78) traced the developing interest in the arithmetic in the out-of-school life of children, beginning with the work of Binet in 1890 and of Phillips in 1897. In another study, Willey (76) showed in brief historical outline the decline of drill and the rise of arithmetic as a social study.

An elaborate series of historical studies was reported by Smith and Eaton (52, 53, 54, and 55), who summarized their findings, with Dugdale,

in a single bulletin (56). Their procedure consisted in the measurement of space devoted to arithmetical topics and processes in textbooks, of which there were eight in the period 1790–1820, twelve in the period 1821–1850, sixteen in the period 1851–1880, thirteen in the period 1881–1910, and ten in the period 1911–1940. To the extent that arithmetic as a school subject can be appraised by their research technic, these authors in their reports provided the best single account of detailed changes which have occurred in the past six and a half decades.

NATURE OF THE LEARNING PROCESS

Brownell (5), writing on “The Progressive Nature of Learning in Mathematics,” called attention to four kinds of instructional shortcomings which, if not traceable to, are at least consistent with connectionistic conceptions of the learning process. These shortcomings are: (a) the tendency to stress the product of thinking (rate and accuracy of response) with a corresponding neglect of interest in the pupil’s procedure; (b) the setting of too rapid a pace in learning, accompanied by failure to furnish children temporary aids which they need if they are to learn meaningfully; (c) the prescription of wrong kinds of practice (e. g., repetitive drill when varied experience is called for); and (d) superficial diagnosis and inappropriate types of remedial teaching. Drawing upon data from previously published research reports, the same author showed the contribution of a particular device (crutch) in the case of borrowing in subtraction (7) and, with Carper (9), traced the course of learning in one arithmetical function (the multiplication combinations) thru the use of group test scores and thru the results of individual interviews.

THE CURRICULUM

Vocabulary Studies

Rolston and Spitzer (51) investigated the extent to which the word “and” is and is not used in connection with oral and written numbers involving three or more figures. In spite of the unanimous recommendation of arithmetic textbooks and books on the teaching of arithmetic that the word “and” be omitted in reading and saying such numbers, they found “and” used in 60 percent of the possible occasions on radio programs and in 54 percent of the cases by twenty-six authors, and in three encyclopedias and six dictionaries.

Wiley (79) reported arithmetical terms and phrases used by children in solving the problems of their daily lives—or, rather, as found in the teachers’ transcriptions of their pupils’ reports. A table was prepared containing about ninety words and short phrases which occurred ten or more times, classified by grades—kindergarten and Grades I and II, Grades III and IV, and Grades V and VI. The author called attention to various factors which in part invalidate the findings as reported.

Measurement

Using twelve third-grade texts, Gunderson (24) undertook to find the amount and kind of measurement expected of children on entering this grade, as one means of determining the corresponding information to be imparted in the lowest two grades. Tables were presented to show the units in each of the common categories of measurement and the space given thereto in the various texts, the percents of book space allotted to this kind of matter, and the amount of space devoted to miscellaneous measures, such as bar, basket, box, etc.

Yorke (82) reviewed three studies, the last one her own, on the extent to which metric units are used in countries where the metric system is legally compulsory. Her own data were secured in the course of visits to four South American countries. There she found that 65 percent of measurement uses reflected acceptance of the metric system, and, 35 percent did not. There were wide differences in the extent to which the metric system was employed, the rural areas, for example, being much more prone to continue with traditional units. Her conclusion was that, on the basis of these facts, there is little argument for teaching the metric system in the United States for purposes other than those of information.

Out-of-School Uses of Arithmetic

Employing teachers in the kindergartens and in Grades I-VI in Santa Clara County, California, Willey (75) collected a total of 2484 problems "which arose in the life of the children and which seemed to have arisen spontaneously out of natural situations." (His data were reported also in reference 77.) The children's problems were analyzed in various ways, and his tables contained classifications (a) according to twelve arithmetical categories (counting, common fractions, subtraction, and so on) by grade level, and (b) according to fundamental operation employed (addition, subtraction, and so on). His findings differed considerably from those reported earlier by other investigators, a fact which may mean that such studies are of limited value, being chiefly useful in the areas in which they are made. One recommendation was that all processes, including concepts now reserved for the higher intermediate grades, should be introduced in earlier grades to allow time and opportunity for their meaningful development.

A somewhat similar study was made by Ellsworth (18), who had 390 children in Grades III-VI in an urban area check daily those of seventeen listed arithmetical topics which had served any useful function in their lives. The uses were then classified. Telling time led the list (27 percent of the total), followed by using money (15 percent), counting (14 percent), and so on, to adding fractions, measuring areas, and dividing, subtracting, and multiplying with fractions, none of the last named five topics contributing as many as 1 percent of the total.

Roberts (50) had 219 unselected employees in various industrial organizations in Houston check a carefully prepared questionnaire, based

upon textbook problems, to find the extent to which they used integers and common and decimal fractions. His classifications revealed that 80 percent of the employees "frequently" (once a week) added four-place numbers, 50 percent "frequently" added five-place numbers, and 34 percent "occasionally" (less than once a week) added six-place numbers. Corresponding types of data were tabulated for other arithmetical units and processes. Recognizing that social utility is not the sole criterion for determining the content of the arithmetic curriculum, he nevertheless urged the making of similar studies with other groups of the population.

Grade Placement

The grade placement of arithmetical topics was the main concern of only two investigators. If this subsidence of interest in this phase of curriculum construction means a general complacency with the stepped-up placement which has become generally accepted in the past two decades, the lack of research is to be deplored. If, on the other hand, it means that investigators are getting ready to attack the factors which are basic to sound grade placement, the lack of research dealing directly with grade placement is a healthy sign.

As noted above, Johnson (34) presented evidence which he interpreted to mean that the stepped-up curriculum in the Chicago schools had proved to be a success. Ulrich (66) analyzed eight textbook series for Grades III-VI, together with their accompanying materials for the first two grades, all published since 1937. His first table summarized the placement of twenty-four topics. His second classified the topics, broken down into details, to show the place of their introduction under the headings "common agreement" (more than half the texts), and "wide variation." It is impossible here to list Ulrich's findings, and the interested reader must be referred to the original source.

Readiness

Associated with the problem of grade placement is that of readiness. Wittich (81) described a readiness test prepared in his system for administration to children entering the first grade and reported data showing typical responses and illustrating the usefulness of the test. Souder (57) announced the construction and evaluation of readiness tests for common fractions.

Carper (15) by careful observation and interview noted the extent to which children in the primary grades are capable of apprehending concretely presented numbers by the use of groups. Previous research had been limited, almost entirely, to counting activities. Finding that grouping was well within the powers of her subjects, she criticized primary grade courses of study and commercially prepared instructional materials for failing to utilize the developing ability and to encourage its further development as a preliminary to the study of the simple combinations. In another place (9) Carper reported data to show that a slightly retarded

group of third-grade children who had had no instruction on the multiplication combinations as such already possessed a considerable body of knowledge about the process, which guaranteed successful results from instruction.

EVALUATION, DIAGNOSIS, AND REMEDIAL INSTRUCTION

The Stanford Intermediate Arithmetic Test was administered to 11,348 sixth-grade pupils in 468 schools in Indiana. Eaton (17) tabulated the results of this extensive survey, involving about a quarter of the total enrolment of the state in this grade, in a variety of ways: city schools, township schools, and special schools; relation of achievement to age of pupils, length of school year, number of classrooms per building, size of classes, size of schools, time spent on arithmetic, and so on.

To find "how the sequence and difficulty of examples affect the score a student makes on a test in division of decimals," Grossnickle (23) studied the test papers of 409 pupils selected at random from Grades VI-VIII. His tests were carefully prepared in the light of his purpose, and his data were well handled. He found that easy examples in the processes were as good for diagnostic purposes as were difficult examples, and he therefore recommended that test examples should be relatively simple and distributed at random with respect to type.

After years of experimental teaching, Fernald (20) described her remedial methods and reported on some of her pupils who were supposed to represent cases of "special disability" in arithmetic. In all instances use of concrete materials as a basis for understanding brought distinct improvement in achievement. The following sentence is especially important for those who ascribe difficulty in learning arithmetic to some shortage in heredity: . . . "there is no such thing as a child of normal intelligence who cannot do arithmetic" (p. 213).

Bemis and Trow (1) raised the important question: What happens after two years of remedial instruction? It has been rather generally assumed that, once a child has been enabled to "catch up" thru remedial teaching, he will proceed at a normal rate. This comfortable belief was rudely shaken by the data in this study, for the results of remedial teaching were found to be exceedingly variable. The authors offered as an explanation a corresponding variety in the maturation level which had been attained by the pupils at the start of remedial work. Another explanation, equally as tenable, is that the type of remedial instruction, which seems to have been drill, was variously appropriate to the needs of the children subjected to it. Whatever the explanation, Bemis and Trow demonstrated the need for suspending judgment as to the worth of remedial efforts until more data are in.

MEANING IN ARITHMETIC

A lengthy bibliography for the past three-year period could be assembled under the caption above. Only a few of the many possible references can be mentioned here.

In general, it may be said that at present there is agreement that arithmetic must be taught meaningfully, tho there are wide variations both in theory and practice with respect to the meanings which should be taught and to the procedures by which they may be developed. Buell (12) was one of the few to raise objections to the trend toward greater emphasis upon meanings. Wheat (72) undertook to refute Buell's criticisms in an article which dealt with: What is meaning in arithmetic? Can pupils grasp meanings? What good is meaning in arithmetic? Tho not written with specific reference to Buell's strictures, Mossman's article (44) may be regarded as in the same category as Wheat's. At greater length than either of the two writers just mentioned, Brownell (8) analyzed the essential meanings of arithmetic which must be taught, considered the objections to the teaching of meanings, and offered reasons why meanings should be developed.

In a series of articles Riess (47, 48, 49) discussed the growth of meaning in the early phases of arithmetical learning; and Van Engen (67) set forth in an able manner the value of what he called "unifying ideas" in arithmetic instruction. Among these unifying ideas are: regrouping in addition; grouping by tens; positional notation; relations of fundamental operations; relation between common fractions, decimal fractions, and percentage; dependence, proof, approximation, and error in measurement. Particularly challenging was his demonstration of the way in which one idea, namely, $7 + n = 13$ (instead of $7 + ? = 13$), permeates the whole of mathematical thinking.

A number of articles described illuminating experiences in the development of meanings. Spitzer showed the usefulness of the abacus in exploring number meanings in our decimal system of notation (58), and, for a similar purpose, the use of what he called a "ten block" for the construction and identification of two-place (and larger) numbers (59). Steiss and Baxter (61) reported how they developed number meanings with concrete materials, and Spitzer and Dunfee (60) told how to teach the multiplication and division facts in a meaningful manner. MacLatchy (40) explained the usefulness of "markers" in teaching numbers, and, with Hummel (41), gave an informal account of the procedures employed in meaningful teaching with a small group of children in Grades III and IV.

Those interested in the improvement of classroom instruction will do well to consult all the references mentioned above. They should also study Wheat's excellent monograph (71) which is treated below and read carefully the report of the special ASF and U. S. Office of Education committee entitled "Essential Mathematics for Minimum Army Needs,"¹ a large part of which is devoted to problems of teaching important arithmetical meanings.

CRITICAL APPRAISALS OF CURRENT PRACTICE

Buswell (14) in a stimulating discussion pointed out five major weaknesses in arithmetic programs: (a) failure to appreciate the value of

¹ See reference (14), Chapter VI.

an abstract use of number in meeting the needs of life (it is sound practice to *start* learning with the concrete, but an error to *stop* it at this level; instead learning must be carried thru to the abstract); (b) lack of ingenuity and insight in devising socially significant illustrations to make arithmetic interesting and to show its relation to life experiences; (c) de-emphasis on arithmetic in the supposed belief that damage is necessarily done to personality by systematic instruction; (d) neglect of noncomputational uses of arithmetic, as in reading and in quantitative thinking; and (e) errors which arise from the attempt to limit the arithmetic program to the "natural" experiences of children.

Bond (2) wrote helpfully on the need of establishing a proper balance between social arithmetic and a science of arithmetic. He pointed out that the former overemphasis on computation has brought the inevitable counter-reaction with social uses now receiving the major share of attention; and he argued, not for an abandonment of social uses, but for the incorporation of these uses into a program which will result in a real apprehension of arithmetic as a science.

STUDIES OF TEACHING AND LEARNING

One of the important publications in this area was Wheat's monograph (71) in which he summarized and integrated the findings of studies by his students, three theses and forty "problems," the latter described as being "somewhat less quantitative" than the theses but frequently "more closely related to actual classroom work." The studies were grouped under "Teaching Methods of Self-Instruction" (twelve studies), "How to Teach and What to Teach" (nine studies), "Problem Solving" (six studies), "Vocabulary of Arithmetic" (two studies), "Difficulty of the Combinations" (perhaps more accurately, difficulty of the processes, two studies), "Managing the Practice" (four studies), "Helping the Retarded Pupil" (four studies), and "Miscellaneous" (three studies). The various investigations are not treated separately here, partly because of space limitations but chiefly because much of their value lies in the orientation and excellent interpretations supplied by Wheat in the monograph itself. The reader should also be able, from the chapter titles just mentioned, to add the Wheat monograph to the bibliographies appropriate to topics already discussed above (e.g., vocabulary studies) and to be discussed below (e.g., problem solving).

Problem Solving

Johnson (31) brought together, summarized, and criticized the thirty-nine published reports of investigations on problem solving, under the heads: (a) causes of difficulty, and (b) improvement of problem solving (relative effectiveness of six different types of attack which have been studied, relative difficulty of various types of problems, relation of practice exercises to success in problem solving). In spite of the fragmentary, inconsistent, and frequently inconclusive nature of research findings in

this area, Johnson expressed himself as optimistic about the possibilities of further research on problem solving.

Hall (25) found it effective to have pupils, working with their own problems, read and discuss them orally, select the appropriate operation in group work, and estimate the approximate answer before solving. His subjects, all taught by himself, were three Grade V and three Grade VI classes.

Hansen (26) administered a total of nine arithmetic tests, ten mental tests, and seven reading tests to 681 sixth-grade pupils. He then compared the 184 best pupils in problem solving with the 184 poorest in problem solving, finding the former superior in all tests except the four Gates reading tests. His announced purpose was to discover "factors associated with successful achievement in problem solving."

Using 898 pupils in twenty-eight seventh-grade classes taught by fifteen different teachers, Johnson (32) undertook to measure the effect of instruction in mathematical vocabulary. Comparing test scores of his control group and of his experimental group (to whom selected technical terms were carefully taught), he found no reliable difference in any part of the Analytical Scales of Attainment, a reliable difference favoring the experimental group on vocabulary tests containing the words taught them, no difference on a test of transfer in learning vocabulary, and superiority for the experimental group on two of his specially prepared tests in problem solving.

Klugman (37) reported that children working together were more successful in solving problems than were control children who worked alone. His pairs were carefully matched for sex, race, grade, CA, and IQ.

Sutherland (63) gave a battery of thirteen tests to 352 children aged ten and eleven. The mean scores made on problems with familiar settings were higher than those on problems with unfamiliar settings. Statistical analysis yielded five factors of importance to success, three of which he identified as *g*, a verbal factor, and a number factor, all apparently equal in potency.

Another elaborate testing and statistical study was made by Treacy (65), in the attempt to learn the relationship between reading skills and problem solving ability. In all, he administered thirteen reading tests, purportedly measuring as many different skills, together with tests in problem solving and in general mental ability. The eighty best achievers in problem solving were compared with the eighty poorest, and the results showed reliable differences in quantitative relationships (scarcely reading at all), vocabulary in context, perception of relationships in content, and integration of disparate ideas. Nearly reliable differences were found in arithmetic vocabulary and in four other reading skills. Having demonstrated markedly dissimilar degrees of relationship between different kinds or aspects of reading (on the assumption that the tests were valid) Treacy drew the somewhat surprising conclusion that future research on his problem must deal with reading as a single unitary ability.

The Simple Combinations

Swenson (64) showed that the difficulty ratings of addition combinations vary with learning method, and so added new evidence that these combinations (and others, by inference) possess nothing which can be called "intrinsic" or "inherent" amounts of difficulty for learning. Wilburn (74) published convincing data to show that a method of self-instruction taught his subjects enabled them to master the addition combinations with relative ease.

Two studies relating to the multiplication combinations appeared. The one, by Wheeler (73), involved 342 children in Grade III who were required to learn the combinations thru playing his game, Mult-O, a drill device. The degree of success attained was slight, a fact which the investigator attributed to the shortness of the experimental period. Brownell and Carper's monograph (9), besides critically evaluating previous research on the multiplication combinations, reported two new studies with large but different school populations, showing the changes in learning which occur in rate, accuracy, and quality of thought process from Grade III-A to Grade V-A (the last-named data having been collected by interviews). The monograph also includes new data on readiness previously alluded to (see the topic Readiness above) and a discussion of problems of learning and teaching in the case of these combinations.

Division

Holland (28) analyzed thirteen sources of difficulty in this process and gave four sets of suggestions for making it easier for the learner. The value and suggestiveness of her discussion was enhanced by her evident experience in working with children on this process. Koenker (39) found that excellent achievers in two-figure division surpassed poor achievers by reliable margins in all aspects of general ability as well as in all specific factors relating to the process as measured by his tests. When the effects of MA and CA were statistically controlled, the superior achievers excelled in all factors except reading.

Grossnickle (22) made a careful analysis of errors in division of decimals, using one hundred papers selected at random over a range of grades. He found twenty-one classes of error, practically all of them "spurious" and "inconstant" (and not "persistent," as has many times been claimed), which he grouped under five main types: Errors resulting from placement of quotient (five subtypes, comprising 40 percent of all errors), errors resulting from shifting the point (five subtypes; 31 percent), errors resulting from 0 (five subtypes; 15 percent), errors resulting from combinations (four subtypes; 9 percent), and miscellaneous (two subtypes; 5 percent).

Concept Development

Employing tests to measure the extent to which concepts relating to common and decimal fractions had been developed, Johnson (33) reached

the conclusions that such concepts were only about 40 percent learned in Grades VI, VII, and VIII and that mental age was a stronger factor than was grade in determining the status of understanding which had been attained

Organization for Instruction

Maguire (43) described how she correlated arithmetic into a unit dealing with citrus fruit, demonstrating that the alert teacher has no difficulty in arranging opportunities for children to use their arithmetic outside the class period. Harding and Bryant (27) showed the possibility of teaching arithmetic "thru functional procedures" and without recourse to systematic instruction on the subject itself. They presented data from an experimental class to show that pupils taught thru "activities" were fully successful in attaining the standards set for control pupils as well. Moreover, they indicated that the experimental children gained appreciably in personal and social adjustment.

RESEARCH IN ARITHMETIC

As has already been stated, Johnson (31) summarized the research done on problem solving and offered valuable criticisms. Knipp (38) analyzed the sixty-four published studies relating to the comparative merits of instructional procedures, with a view (a) to discovering trends in experimental interest, procedures used, and results obtained; also (b) to ascertaining whether there was any relationship between interest in the specific fields of investigation and reported results, or between procedures and results.

Wilson (80) called attention to the need for research on the skills, appreciations, and knowledge of arithmetic which are of demonstrable value, rather than upon items and processes for which no convincing case can be made. Using data from the study on the multiplication combinations mentioned above, Brownell (6) undertook to show the need to include in evaluation some evidence on the degree to which children are actually growing in power of quantitative thinking. His recommendation would mean more concern about children's processes as contrasted with the rate and accuracy of their products alone and would probably mean the more extensive use of such research technics as observation and the interview.

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CHAPTER III

Teaching of Science in Grades VII, VIII, and IX

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Problems Related to the Reading of Science

Two investigations of reading problems related to general science, those by Swenson and Shores respectively, deserve special consideration, because of the elaborate and careful statistical technics employed. Swenson (19) attempted to determine what differences and similarities exist among reading materials used in general and scientific material in their relation to rate, vocabulary, and comprehension. From the seventy-five best and the seventy-five poorest readers, selected from 217 eighth-grade pupils on the basis of their scores on a standard reading test and a battery of reading tests of science materials which she had constructed, the investigator matched eight groups on the basis of chronological age and mental age to provide a basis of comparison between good and poor readers with respect to various factors in general reading and in reading science materials. She computed T ratios "to indicate the probability of differences in the performance of upper and lower matched pairs."

The investigator found more evidence of similarities than of dissimilarities between science and general reading. She concluded that good readers measured in one type of reading test are likely to be good readers as measured by other types; that rapid readers of science materials are not significantly superior in comprehension of either science or general reading materials, or in science or general vocabulary; and that there are more likely to be differences between phases of reading skills, such as vocabulary and comprehension, than between science and nonscience materials.

Shores (17) investigated the relationships between certain reading and study skills and reading comprehension of science and history materials. Only the aspects involving the general and the science materials are considered here.

Using 380 ninth-grade pupils, the investigator paired groups on the bases of mental age and ability to read literature. He used the generalized matching-control technic of Johnson and Neyman to determine differences in mean ability in various measured skills.

His findings indicated that the ability to read science is significantly related to comprehension of history materials; knowledge of science vocabulary; knowledge of general vocabulary; ability to read graphs, charts, and tables; understanding of details; and total score on measured skills of silent reading comprehension. Like Swenson, Shores found the good readers of science materials superior also in the detailed and exacting skills of reading.

In contrast with Swenson's conclusions, however, Shores affirms that by the time pupils reach the ninth grade, their reading proficiency is largely specific to the content fields, and that the evidence from his study refutes the concept of general reading ability in the ninth grade. This variance between the conclusions from the two investigations furnishes stimulating evidence of the need for further research along these same lines.

Of special significance is the emphasis by both these investigators upon the need for every classroom teacher to be a teacher of reading.

Uses of Motion Pictures

Using 800 pupils in eighth- and ninth-grade general science classes, Krasker (8) compared the relative effectiveness of having motion-picture films viewed by small and by large groups when the pupils were permitted during the showing to take notes, ask questions, and contribute discussion; and compared the relative effectiveness of a "nonpreparation" and a "preparation" method. The latter consisted of a showing of the film followed by a preparation providing study of the film thru a list of questions based upon it, and then a second showing. Groups were equated "socially, educationally, and mentally." Five films were used in the second part of the investigation.

Of significance (despite incompleteness of the report), in view of the present-day practice of organizing large classes, is the finding that a higher degree of mastery of facts was achieved by pupils in the small classes than in the large ones. This finding is in harmony with that of Hurd in his earlier study of achievement in high-school physics. Of interest, also, is the conclusion that the mere showing of a film does not give a sufficiently satisfactory learning result to justify stopping the instructional activities in order to introduce it.

Jayne (6) reported a comparison of the informational gains from listening to a lecture, with those from seeing a silent motion picture presenting the same materials; and of the retention of informational gains from the two methods of presentation, over periods ranging from three to fifteen weeks. From a random sampling of 271 pupils, he secured two "equivalent" groups, each of five classes of general science. Choosing two films he constructed lectures from notes taken on repeated reviewings of the films. He used blackboard sketches and diagrams to illustrate each lecture, which was made to occupy the same amount of time as the showing of the corresponding film. The rotation method of investigation was used and the results were determined from critical ratios based on standard scores on specially constructed tests.

The results both for immediate and delayed recall of factual information favored the lecture over the film. In view, however, of the relatively limited general use of the lecture method in the junior high school and the decreasing emphasis upon the mere learning of facts as an important aim of courses in science, the effect of this study would seem to be to

emphasize disadvantages resulting from the indicated use of silent motion pictures rather than to establish the desirability of teaching general science by the lecture method.

Of interest are the investigator's statements that the increase of factual learning gained from visual materials is due primarily not to the visual experiences solely, but to the combination of the visual experiences and other teaching procedures; that, as may be inferred, also, from Krasker's conclusions, teachers are not justified in eliminating other types of experience in order to show films; but that the best results are likely to be obtained from a combination of films with all other teaching methods and devices.

Uses of Illustrations in Textbooks

Kambly (7) reported a unique study, partly involving general science, in which he attempted to discover whether pupils "study or even look at" the illustrations in their textbooks, and whether the proper use of illustrations by pupils and teachers contributes to pupil achievement. He administered to two groups each composed of three classes in general science, a test of items of information derived from the illustrations in a three-week unit of text material. One group then studied the materials in the text; the other studied the same materials in mimeographed form. Conditions within both classes were kept as nearly uniform as possible during the experimental period at the end of which the test was again administered to both groups.

The findings showed a "significance ratio" of 1.97 in favor of the group that had had access to the illustrations, tho approximately half these pupils were unable to answer accurately, questions about them. The evidence indicated, also, that illustrations when "properly used by pupils and teachers do contribute to pupil achievement."

The study should stimulate textbook authors and classroom teachers to make more definite uses of illustrations. The investigator affirmed that this objective evidence indicates "that teachers must help pupils to learn to study the illustrations in their textbooks."

Aspects of Problem Solving

Teichman (20) attempted to determine the effectiveness of a problem-solving technic in teaching ninth-grade pupils to state inferences from given facts, to select the best conclusion from four proposed, and to evaluate proposed conclusions in terms of reasonableness, sufficiency, and pertinency of data. Eight classes served as experimental groups and twelve others as controls. The groups were matched on mental ability and the sums of standard scores on tests constructed by the experimenter to measure the ability to make conclusions. Conclusions from the study were based on standard scores and various coefficients of correlation.

As would be expected, the groups which received training in problem solving gained more than did the control groups. Also of significance is

the finding that pupils who were dull and were poor readers were nevertheless able to improve in ability to make conclusions.

The investigator concluded that, while pupils who are superior mentally and who possess superior reading skills prove more likely to show high initial skill in making conclusions, mental ability and reading skill are "very poor indications of ability to improve one's skill in making conclusions." Further, he states that the ability to state conclusions, to select the best reason for a conclusion, and to select the best conclusion from several are not identical abilities.

This investigation makes a substantial contribution to the study of scientific method and also adds evidence to the cumulative findings of a considerable number of earlier researches which indicate that far better results in attaining desired outcomes are derived from employing teaching procedures directed toward specific objectives than can be obtained concomitantly from attempts to achieve other instructional goals.

Curtis (1) reported a study to determine the types of questions demanding reflective thinking and the frequencies with which these various types were employed in recent general science textbooks and workbooks. The first phase resulted in determining sixteen distinctive types of thought questions. The second phase was the analysis into these sixteen types of the questions found in six textbooks and seven workbooks of general science.

It was found that most of the questions included in the materials analyzed represented in substantial numbers only a relatively few types. In the textbooks 84 percent of the thought questions were those involving explanation, recall, decision for or against, discussion, and cause and effect relationship. In the workbooks, the most frequently represented types were those involving recall and relationship.

The evidence led the investigator to the same conclusion stated by Cunningham in relation to his somewhat similar study reported in 1925, namely, that in texts and workbooks written for junior high-school science, insufficient use is made of many types of questions that stimulate reflective thinking.

A possible value of this study to textbook authors and teachers lies in its descriptions and illustrations of the various types of thought questions and the implication that all these types should be introduced into teaching materials and classroom activities.

Textbook Contents

Novak (11) added another analysis of the content of general science textbooks to the long list of such investigation that began with Howe's report in 1919. He estimated to the nearest quarter page, in nine texts, the amounts of space devoted to the various topics.

As would be expected, he found a wide variation in the amounts of space devoted to the same topics in different texts. Also, he arrived at the same conclusion with respect to the relative amounts of biological and

physical materials, that all previous investigators of the same problem, without exception, have stated, namely, that a considerably greater portion of the content of general science textbooks is devoted to physical than to biological science (65.5 percent as compared with 34.5 percent). The implications of this conclusion to authors of textbooks and constructors of curriculums are not clear, since the various attempts thus far reported to synthesize, statistically, the content of general science textbooks with other appropriate materials revealed by curriculum investigations of other sources, present in their resulting composite outlines a preponderance of physical over biological materials.

Values of Science Notebooks

Krause (9) reported an extensive study to determine whether the science notebook "can be taken as a valid measurement of achievement" and as a reliable basis for judging pupils' work in general science; and whether "the prevailing emphasis upon the notebook" is justified. After formulating criteria for writing and for marking notebooks, the investigator gave 249 boys in fifteen classes of seventh- and eighth-grade science careful instructions in "the various ways of writing a notebook," and practice in making and interpreting analytical drawings and in taking notes. He measured "acquisition of factual knowledge and general information," "development of a scientific attitude," and "ability to apply scientific facts, principles, and knowledge toward explaining common phenomena." He used sigma, or z , scores computed from scores on original and standardized tests together with weighted notebook scores as the basis for determining a series of coefficients of correlation.

From various findings, the investigator concluded that "there is little justification for the compulsory writing of a science notebook of the type investigated." This conclusion agrees with those arrived at earlier by Mayman and by Applegarth, but not with those announced by Baird and by Phillips. The implication seems plain, therefore, that much additional evidence must be obtained before the general and (more important) the specific values of pupil recordings of their laboratory experiences can be conclusively determined.

Integrating General Science and Algebra

A study by Gorman (2) compared the effectiveness of teaching integrated mathematics-science in the seventh and eighth grades with that of teaching the same materials in separate classes in these grades. The materials used were obtained from a survey of the content of textbooks of mathematics and of science. The work with the seventh-grade class was preliminary and preparatory. The actual learning study was carried on with two eighth-grade groups equated on the basis of "promotion quotient." The work was taught as a series of problems involving individual and group activities with integrated materials, to the experimental group; and with

the same topics in basic textbooks of science and mathematics to the control group.

The results of the investigation revealed no "appreciable" differences in the learning by the two groups. Great significance, however, can scarcely be attributed to this finding because of the incompleteness of the statistical treatment as reported, and because also of the small groups of pupils involved. Of interest, however, is the investigator's conclusion that it is possible to integrate, with topics usually included in seventh- and eighth-grade science courses, practically all the topics commonly presented in a course in seventh- and eighth-grade mathematics.

Materials for Course Enrichment

Studies of scientific interests as one basis of selecting course content, have been appearing in considerable number and variety since Trafton's pioneer study was first reported more than forty years ago. In a recent investigation, Sisson (18) sought to secure materials for constructing a seventh-grade general science course, from a study of the scientific interests of the pupils and of the scientific topics they best and least well understood. Unfortunately, the technics employed and the ways in which the data were to be used in course construction are not completely and clearly indicated in the report.

The investigator concluded that the scientific interests of pupils are not constant. This statement is in harmony with Fitzpatrick's conclusion and at variance with Zim's, from their earlier studies of the reliability of children's interests. The pupils were found to have more knowledge of physical than of biological science, and, apparently, (as was found in earlier studies by Pollock, Curtis, Craig, and Washburn) to be more interested in the former than in the latter. Of chief significance, perhaps, as an indication of the need for further experimentation, is the investigator's further conclusion that pupil interest centers in *aspects* of topics rather than in large topics.

Beginning with the pioneer study of *Biology in the Public Press* published by Caldwell and Finley in 1923, there have been frequent and varied reports of analyses of newspaper science. Novak (10) measured the length in column-inches, of the materials dealing with science which appeared in four years' issues of the *New York Times*. He found about one-fifth of the total space devoted to health and medicine; and about three-tenths more concerned with discussions of communication and transportation, animal life, man and behavior, and gardening and agriculture. The investigator found that during the entire period, practically equal amounts of space had been devoted to physical and biological science.

A "simple survey" by Relyea (12) was made of the articles read by pupils in seventh-, eighth-, and ninth-grade classes in connection with occasional "current-science days." The pupils were required to read and report upon scientific articles in periodicals, but the nature of their choices was

left to individual preference. An unsigned questionnaire was used to secure evidence relative to the nature of the articles and the student opinions of the values they thought they had derived from such reading.

Most of the articles dealt with medicine and disease, aviation, and chemistry. Perhaps the chief value of this study lies in its emphasis, in agreement with findings of earlier studies, upon values to be derived from extensive reading of general science.

Investigations such as the three just considered by Novak (10) Relyea (12), and Sisson (18) provide suitable materials with which to enrich courses of general science. They may be of greater potential value, however, as sources of data to be used in syntheses such as the ones by Robertson, Wise, and Martin, leading to the determination of scientific principles appropriate to courses of science.

Other Aspects of Junior High-school Science

Hunter and Parker (4) presented a phase of the latest of a series of extensive questionnaire surveys of science teaching, which the former has carried on from time to time over a period of several decades. Only aspects related to science in junior high schools are considered here.

The attempt to confine the presentation of even a small segment of so extensive a study to a few pages has prohibited the authors from presenting their data in a form which can be readily assimilated and evaluated. Perhaps the chief value of this report is the evidence it furnishes that the study of general science proves of considerable value to pupils who subsequently study more advanced science courses. This finding provides some confirmation of the results obtained fifteen years ago by Carpenter from his investigation of the relative success of pupils in chemistry and physics who had, and who had not studied general science.

In a report of another phase of Hunter's serial investigation, Hunter and Spore (5) stated that general science is most frequently offered thruout the country in the ninth grade of the junior high school. Hilgers (3) found that general science is taught "as a required course in grades seven, eight, and nine in practically 100 percent of the [277 Minnesota] schools."

Hilgers (3) found, also, that the following teaching methods were used in percentages ranging from 92 to 37 percent of general science classes in 277 Minnesota high schools: supervised study (92 percent); class discussion (90 percent); text assignment and recitation (88 percent); references and reports (87 percent); problem (63 percent); lecture (57 percent); and contract (37 percent).

Rumble (13, 14, 15, 16) contributed a series of reports, of which more may appear later, of the history of science at the junior high-school level. Three deal respectively with the Colonial Period, and with the periods from 1776 to 1827, and from 1827 to 1857; the fourth discusses the origin of junior high-school science.

Among the voluminous findings, are the statements that science materials at the junior high-school level were introduced into the schools "by

way of Morse's geography textbooks as early as the last years of the eighteenth century"; and that the use of visual aids, such as blackboard drawings, science equipment, models, and "other means of supplementing direct study of natural phenomena," were coming into use almost a hundred years ago.

Concluding Comments

The reviewer of reports of educational research cannot help decrying the common practice illustrated by several studies included in this section of "popularizing" accounts of investigations thru incomplete reporting, in efforts to make them understandable and less formidable to readers untrained in educational research. It seems probable that such practice serves neither the research specialist, nor the lay reader. An adequate account of the essential procedures and technics followed by a statement of implications for the classroom teacher might prove more generally useful.

There is a wider spread of excellence of investigational and statistical technics between the best and the poorest studies here reviewed in the chapters on science at the elementary and junior high-school levels than has been previously evidenced in the studies representing similar periods of time. This increasing difference is due not to decreasing merit in the poorer studies but to marked advances in the major ones.

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CHAPTER IV

Teaching of Mathematics in Grades VII and VIII

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The Curriculum for Grades VII and VIII

UNTIL comparatively recent times there has been little in the mathematics program for Grades VII and VIII which could serve to distinguish it as a definite stage in the development of mathematical power. The reason is largely historical. In the days when most children withdrew from school after the eighth grade, curriculum makers found it expedient to assign the fundamental operations with integers and fractions to the lower and intermediate grades and to use Grades VII and VIII in which to teach the important social applications of number. This traditional program has persisted even tho the conditions for which it was framed no longer exist. In many modern schools the result has been to provide a mathematics program for these grades which strongly resembles a series of social studies units. Important as social applications are, the fact remains that these two years have constituted something of a mathematical plateau marking the termination of the first period of mathematical development and a "breather" before beginning the new work of the high school.

Overcoming the inertia of tradition has not been easy, even in these days popular for curriculum revisions. The mathematics courses of study for Grades VII and VIII have been caught between the demands for an upward revision of the elementary-school curriculum on the one hand, and the "preparatory" demands of the high school on the other. The militant forces at either flank have made it difficult to take a positive position in the development of a distinctive program. Nevertheless progress has been steady, if slow. Schorling (12) prepared a general summary of the important changes in junior high-school mathematics in the last quarter of a century. Trends were cited to show that the junior high school is becoming less concerned with the problem of "preparing the pupil for something" and more with the need of placing him in an environment where he will develop normally.

In the past three-year period one new study, covering the work for Grades VII, VIII, and IX, was added to those reported by Grossnickle (6) in the October 1942 issue of the *REVIEW OF EDUCATIONAL RESEARCH*. Arenwald(2) reported the reorganization of the mathematics curriculums for the junior high schools in New York City. The new program features (a) the introduction of arithmetic into the IX-A course of study to provide opportunity for correlation with algebra, civics, and other subjects taught in the ninth year; (b) informal geometry in all grades of the junior high school; (c) instruction in algebra beginning in Grade VIII-A and continuing thru Grades VIII-B, IX-A, and IX-B.

The comprehensive report of the special committee of the National Council of Teachers of Mathematics on the mathematics essential for minimal nontechnical army needs is bound to have considerable influence upon junior high-school mathematics. This study, reviewed in Chapter VI on mathematics in the high school, showed a teaching imbalance in favor of computation with serious deficiencies in mathematical understanding, meaning, and application. Suggestions were offered in the report for correcting these shortcomings. The significance of this study is enhanced by the fact that every item recommended in this investigation can be justified in terms of general education. Mallory's checklist (10) offered to teachers and administrators a convenient reference to the mathematical subject-matter reported in the original investigation.

Methods of Instruction

The nonfunctional character of much arithmetic instruction has long been the source of much justified criticism. Several studies reported efforts to meet this criticism. Gorman (5) studied the possibilities of a closer association between science and mathematics by comparing results of instruction based on an integrated plan with the traditional plan of teaching the subjects separately. With small sections of better-than-average pupils no appreciable difference was found between the effectiveness of the two methods under the conditions established. Montgomery (11) reported experiences in teaching a functional unit on the cost of owning and driving an automobile.

Leete (9) and Gordon (4) offered teaching hints for the closer correlation of arithmetic and algebra. These suggestions provide further implantation to a trend toward a more highly integrated treatment of the two subjects so completely but illogically separated until recent times. Brown's suggestion (3) for teaching percentage without the troublesome "three cases" was another recommendation illustrating the same trend.

Anderson (1) called attention to the interdependence of reading and computation in problem solving and reported his experience with non-academic boys in making problem solving functional. He viewed any difficulty interfering with the interpretation of a problem as a reading difficulty. Group discussions were used to develop a meaningful, "visualized" solution and to lay down the habits of interpretative procedures which are essential preludes to paper-and-pencil work.

Remedial Arithmetic

Two studies showed the value of a systematic and individualized program of remedial instruction in arithmetic. Guiler and Edwards (7) used diagnostic charts, individual graphs of progress, and instruction based upon specific pupil needs with his experimental group, while paired controls were given systematic instruction but without diagnosis. The group instruction based upon individual diagnosis was more effective. Sister

Mary Jacqueline (8) used a highly individualized practice program and finely graded practice materials to help seventh-grade children overcome serious arithmetical deficiencies. The program was largely self-directed and paced in order to capitalize upon any success the children were experiencing.

By way of summary it seems desirable to call attention to the poverty of research in this area during the past three years. Of the twelve articles mentioned in the bibliography only four represent reports of experimentation. Of these four, only three present quantitative data to support their findings. Finally, it may be asserted that none of the three attacked what may be called a vital issue in the field. It is to be hoped that interest in postwar mathematical reorganization will stimulate more experimental activity during the immediate future.

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CHAPTER V

Teaching of Science in Senior High School and Junior College

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THERE has been a decrease in the number of statistical and historical studies in the field of science education during the last few years. Many of the articles that have been published are on the borderline between research and discussion. The important contributions have been made that support findings reported previously, there has been relatively little research reported that may be classed as definitely new findings. As yet there have been no careful studies reported on questions raised by the newer developments in curriculum, and there is a sharp contrast between the ideas dealt with in these articles and the current ideas of curriculum workers. The articles reviewed here are grouped under the following major headings: objectives, content and organization, aids to teaching, methods of teaching, interest studies, improvement of science teaching, measurement, vocabulary studies, and trends in science education.

Objectives of Science Education

Hunter and Spore (30) conducted an investigation on a nationwide scale in which they gathered data concerning objectives of science teaching actually being used in secondary schools of the United States. Their findings indicate that the objectives which are receiving much emphasis from leading educators today have not yet had serious consideration by science teachers. As objectives, consumer education and conservation education ranked much lower than expected.

Content and Organization of Science Courses

Wise (60) made a study of the relative importance of principles of physical science for general education. He ranked some 264 principles of physical science. The upper 25 percent included 55 in the field of physics, 8 in the field of chemistry, and 3 in the field of geology. The lower 25 percent included 36 principles of physics, 27 principles of chemistry, and 3 principles of geology. He concluded that: no one specialized area of physical science is more important than all material drawn from other areas; the study of physics has greater value for general education than does the study of chemistry; a relatively large number of major concepts in the field of chemistry do not possess high value for general education; and some principles from the field of astronomy are very important for general education.

Hollinger and others, (27) outlined a course in physical science which was presented to teachers in June 1941. As yet no formal evaluation has

been reported, but the course work has been found stimulating to teachers and pupils. It has been necessary to make more detailed suggestions to teachers in order that pupil activities may be more effective. Grant (22) discussed cooperative science study at Arsenal Technical High School. Brown (8) discussed the reciprocal relationship between mathematics and physics. Since mathematics is a vital tool in attaining many of the understandings in physics, and since physics contributes a background of real experience to mathematics, much is to be gained by a closer working relationship between the two fields. Everote (18) discussed term problems used as an integral part of the chemistry course presented at the Susan Miller Dorsey High School in Los Angeles. Included are problems related to the community such as control of the water supply, science in agriculture, food supply, and so on. The data collected from a follow-up study of 225 students indicated that favorable results are obtained by students taking this type of course.

Stephenson (52) discussed physical science courses for liberal arts students. Van Peursen (58) conducted a survey of quantitative analysis courses in the United States. He found a wide variety of courses with considerable variation in the percentage of class time and laboratory time, and no uniformity in the subjectmatter content of the courses.

Aids to Teaching

Carlson (10) reported on an investigation of the equipment and offerings in the natural sciences in liberal arts colleges. ". . . figures on the teaching budget show clearly that this is not an age of science in colleges and universities. . . ." Many colleges were found to be significantly inadequate in the number of current journals and periodicals of science made available to students. In general, laboratory space and physical equipment were adequate.

Joseph (32) developed a source book of extracurriculum activities in physical science for senior high schools. "In the original document, each of 185 activities is to be found on a single and separate page."

In the area of visual instruction, Graham (21) reviewed research studies and made a sampling study of the use of visual aids in the teaching of general science in the secondary schools of the United States with special emphasis on Kentucky. Miles (37) reported on auditory aids in the teaching of science.

Methods of Teaching

Swan (53) studied the relative efficacy of two methods of teaching agricultural chemistry at the high-school level. He attempted to determine whether farm boys and girls learned chemistry facts and principles and acquired the ability to apply these facts and principles to new problems equally well by the topical assignment method or the discussion method. He concluded that there was not statistically significant difference in the results. Peterson (42) compared the achievement of students in the tradi-

tional high-school physics and chemistry courses, each of one year's duration, with the achievement of students in the integrated courses in physics and chemistry over a one-year period.

Waters (59) conducted an experiment to find out what analytical results would be obtained by "run of the mill" students using two procedures which were as nearly identical as practicable. The essential difference in the procedures was a reduction in the volume of reagents employed and the substitution of a centrifuge for filtration. He found that students obtained more accurate results using the semimicro technics than when using the macro technics.

Interest Studies

Davies (13) investigated college students' interests in biology using an "interest-information" checklist. Students rated each topic on the basis of much interest, mild interest, or no interest. Results are reported for botany and zoology in both graphical and tabular form. Feder and Wright (19) reported an attempt to develop a means of evaluating the effects of different motivations of students in college physics. An attempt was also made to evaluate insight into the subjectmatter as revealed by student ability to apply physics material to everyday life.

De Lano (15) showed that certain concepts cannot be satisfactorily developed with elementary-school students and that grade placement of all important concepts should be made. Phelps (43) investigated the desirability of using city boys to help relieve the shortage of farm labor. His results indicated that supervised farm work experience ". . . can send the youth back to the city with an insight into rural problems that will make him a better citizen for the rest of his life."

Pruitt (45) summarized the results of four studies whose major purpose was to determine the status of science teaching in the high schools of Oklahoma in 1940. The findings indicated: the science teachers were not as well trained as they should be; they were a very mobile group; they were underpaid; and they did not keep professionally up to date.

Siebens and Bartlett (51) indicated the possibilities of enriching the life of the school by close cooperation between the librarian and the science teacher. This included using all the library facilities in developing units of study. Teller (54) proposed enriching science teaching by commemorating November anniversaries of famous men of science. A bibliography of source material is given.

Higgins (26) made an exploratory study in the field of biology in regard to individual abilities. Decker (14) studied the relationship between natural resources and the activities of the people of Colorado. He found that neither the study of resources, nor the study of people's activities, is sufficient for an understanding of community problems. In this study, then, is one more indication that science teachers must deal with social issues as well as with physical forces. Reimann (46) discussed the use of a correlating subject in science teaching, giving illustrations. Using the

topic "cancer" as an example, he showed how mathematics, chemistry, physics, psychology, and sociology are all correlated. Reiner (47) investigated the value of cause and effect in science teaching. Nixon (38) studied the teaching of biology for appreciation. Nordau (39) discussed some of the limitations of objective mental tests as measures of ability to succeed in science. Damerell and Booth (12) discussed technics for improving the teaching of quantitative chemical analysis.

Measurement of Outcomes of Instruction

In the field of science education new emphasis has been placed on the measurement of the results of instruction. Ashford (2) and Hered and Thelen (25) discussed the chemistry tests of the Armed Forces Institute. These reports described the procedure used in standardizing both the civilian and military (secret) forms of the tests, and the procedure for granting credit for high-school and general college chemistry to members of the armed forces. Results from preliminary tryouts are discussed, and some of the implications for instruction are noted.

Calandra (9) discussed the proposed extensions of the college chemistry testing program to include quantitative analysis and physical chemistry as well as general chemistry, qualitative analysis, and organic chemistry. National norms are given for the Cooperative Chemistry Test, Form 1942; the Qualitative Analysis Test, Form Q; and the Organic Chemistry Test, Form S. The scores are further classified on the basis of vocational goals and types of schools and colleges. The future of the testing program is discussed. Adams (1) reviewed some of the critical teaching and testing problems and controversial issues resulting from past practices. "The results of the author's questionnaire gave ample proof that teachers of general college chemistry are interested in new and improved testing devices, particularly as these relate to laboratory achievement." Very little progress has been made in developing adequate testing devices for measuring achievement in laboratory work other than the acquisition of knowledge. Hendricks (24) made a survey of examination practices in general college chemistry. Answer papers of more than thirteen hundred students from eight different colleges were studied, and the validity and difficulty of each question on the examinations were determined. (See article for procedure.) It was found that 44 percent of the questions were either faulty or at most did not contribute greatly in giving desirable information about the students' achievement. "... then there is still much to be done if college chemistry examinations are to have a large percent of their questions eligible for the label 'good.'" Duvalle (16) made an evaluation of the standards of chemistry teaching in the universities and colleges for Negroes in the United States. Blick and Andrews (6) made a study of the mastery of general chemistry by trainees in the AST program at the University of Connecticut. Determinations of the simple linear correlations between various standardized tests were also reported. The results indicated a satisfactory degree of mastery of general chemistry, and

showed that the trainees can be judged in terms of the civilian college student. Coefficients of correlation found were comparable to those accepted as evidence of validity for achievement examination. Martin (36) made a diagnostic and remedial study of failures in freshman chemistry at Purdue. At the time of publication, complete results of the remedial measures were not available, altho preliminary results seemed quite successful.

Heidel (23) measured and compared the outcomes of instruction of a general high-school senior science course stressing practical applications and consumer education and a conventional high-school physics course employing the lecture demonstration method and stressing classical applications and problems. Neither course proved effective in bringing about significant changes in scientific attitudes, and the general high-school senior science course proved no more effective than the conventional high-school physics course in attaining consumer outcomes. Everote (17) analyzed modifications of student growth resulting from a course in experimental science in which emphasis was placed upon services rendered by the natural sciences to selected experiences with the social, industrial, and recreational environment. Brewer (7) studied factors affecting achievement and changes in students in a physical science survey course given at Queens College in New York City. He concluded: "Many educators influential in the development of science survey courses have stressed the importance of developing attitudes in students . . . the results of this study suggest that they do not develop automatically with increase of scientific knowledge. . . ." Priesche (44) studied the relationship of certain measurable factors with success in secondary-school physics, and Rosenquist (48) investigated some factors influencing final marks in an introductory course in college biology. Barnes and Mouser (3) developed a test of biological misconceptions for use in the general biology course offered by the general division of the College of Liberal Arts and Sciences at the University of Illinois. They reported their findings on the comparative performance of high-school and university freshmen. Teller (55) proposed some new forms of the recognition test, and Wright (61) applied the modified true-false item to testing in chemistry. Scates (49) discussed some of the limitations of the use of standardized tests by the classroom teacher.

Progress is being made in the more objective measurement of desired outcomes of instruction other than the acquisition of knowledge, such as attitudes, ability to apply generalizations, changes in behavior, and so on. Fleming (20) made an analytical study of certain outcomes of a course for orientation in biological sciences in which he proposed to measure, analyze, and evaluate: the recall of specific information; the understanding of generalizations; the elements of problem solving; and the scientific attitudes developed. "The results and possible implications of this investigation are presented in the form of generalized statements. . . ." Urban (57) experimented with two groups of equated biology pupils in

regard to changes in overt behavior. He concluded: "Changes in overt behavior may be made a practical goal or objective of learning; changes on overt behavior can be estimated by techniques commonly used in educational research; . . . changes in overt behavior seem to be of a more permanent nature. . . ." Ter Keurst and Bugbee (56) developed a test on the scientific method; Owens (41) investigated the ability of students to recognize and apply scientific principles to new situations; Kraus (33) made an evaluation of the pupil-made notebook in relation to certain measureable outcomes in the teaching of general science; Johnson (31) studied growth in ability to acquire and apply facts and principles; and Hoyt (28) developed tests of certain linear hypotheses and studied their applications to educational problems in elementary college physics.

Vocabulary Studies

Schneck and Curtis (50) determined what science terms are most important and should, therefore, be included in a glossary of textbooks of high-school physics. Two hundred and fifty terms are listed which were found most important by the combined judgments of thirteen authors of textbooks and forty-six professors of physics. O'Leary (40) determined what physical science terms appeared in recent magazine articles and compared his findings with similar studies made previously. He found that the physical science vocabulary of laymen's periodicals changes with the times, and he suggested that similar studies should be made at least every ten years. Curtis (11) investigated the mathematical terms used in secondary-school textbooks of science. He studied the relationship between the vocabularies of mathematics and science. Criteria were set up to be used in the selection of mathematical terms. Tables show the distribution of mathematical terms in high-school textbooks of physics, chemistry, general science, and biology and list the different difficult mathematical terms which occurred on an average of three or more times per book or which occurred in half or more of the textbooks of physics, chemistry, general science, and biology. ". . . much the largest average number of different difficult mathematical terms was found in the textbooks of physics and the smallest in the textbooks of biology."

Trends in Science Education and Research on Science Education

Leavitt (34) discussed and analyzed changes in the subjectmatter of teaching science in a school in New York State. Hunter (29) made a survey of trends in the teaching of science covering such items as: interrelation of courses, science enrolments, applied science, laboratory or demonstration, and the noncollege group. Bennett (4) made a study of the trends in the amount of mathematics and science taken in high school. This study covered 7208 high-school graduates embracing a typical cross section of college students. He found the following trends in mathematics:

only a slight downward trend in algebra; a much sharper downward trend in geometry; and a greater variation in the length of high-school courses. He found the following trends in science: much uniformity in the length of courses; a steady decline in the percentage of students who have had high-school physics; a continuously increasing percentage of enrollments in chemistry up to 1935, followed by a slight decline. He found also that botany has all but been eliminated, and that general biology has gained consistently.

Blick (5) reviewed recent trends in research on science teaching. In agreement with the findings in this review he reported that there have been fewer studies made in the teaching of science in recent years; studies that have been reported are in general of better quality; there appears to be a trend away from the historical type of research; and that there has been an increasing emphasis on procedures for defining student need and on procedures for serving them.

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CHAPTER VI

Teaching of Mathematics in High School and Junior College

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AN unusual amount of attention was given to arithmetic in the high schools and colleges during the period under review. Data were published indicating that many high-school and junior college students were unable to solve arithmetic problems of an elementary sort. Altho many schools established remedial or "refresher" courses in mathematics, relatively few studies of the effectiveness of such work have thus far been published.

Arithmetic in High Schools

Blair (5) reported the results of a nationwide survey of remedial programs based on replies to a letter sent in 1940 to 1090 principals of public high schools in towns whose population was 20,000 or more. Replies from 379 schools in thirty-eight states included 166 which described work in remedial arithmetic. They revealed that it is generally handled in one or more of the following ways: (a) remedial arithmetic classes; (b) special curriculums for pupils of low mental ability; (c) general mathematics classes; (d) special arithmetic classes for high-school seniors; (e) courses in commercial arithmetic, business arithmetic, shop arithmetic; (f) teachers in regular classes. Of these the first is most common, altho the length of time pupils take the remedial work varies greatly. Tests on arithmetic fundamentals are widely used to select pupils who are to take the remedial programs.

Stimulated by unfavorable comments on the results of an arithmetic test given by the Navy, Christoffersen and Wittich (8) gave the same test to graduating seniors in a large high school. Later a twenty-five minute "chalk talk" on the fundamental processes and a parallel form of the test were given. The median score increased from 73 percent on the first test to 88 percent on the second, leading the authors to suggest that poor retention rather than the quality of the first teaching explains the low scores on such tests.

In more detailed studies Guiler and Hoffman (21) found serious arithmetical deficiencies among 238 ninth-grade pupils in one school in Ohio. On the basis of an arithmetic test they selected 108 students for remedial work. Of these, fifty-seven were enrolled in algebra and the rest in applied mathematics. For eighteen weeks, thirty-five minutes from each of two periods of the algebra class were allocated to systematic instruction and practice in arithmetic based on an individual diagnosis of difficulties. The other students took these courses or junior business training in the usual way. Mean scores on the final retest were 32.7 and 25.8 for the remedial and nonremedial groups, respectively, representing gains of

10.2 and 2.0 points. In a later report (20) the study was extended. Tests were given to 836 ninth-grade pupils in four school systems and results published in the form of error-quotients show the extent of arithmetic deficiencies of various types. Also reported (20, 22) were data from one city showing that algebra and remedial arithmetic taught together as indicated above give better results, in general, than algebra alone. The achievement in algebra as measured by the Ohio Every Pupil Test in Elementary Algebra prepared for April 1943, was approximately the same for each of two groups of about fifty-seven students. The algebra and arithmetic group, however, made an appreciable gain in arithmetical computation abilities, while the group which studied only algebra made practically no gain in arithmetic.

Brueckner (7) conducted an extensive study which included data on the effects of remedial treatment. He obtained data from ninety localities in thirty states by giving a thirty-item test of abstract arithmetical computation. The mean number of correct responses in Grade XII ranged from 8 to 25 in the different schools, the mean of the distribution by schools being 17.3 or 57.7 percent. This was compared with the means of certain groups in the University of Minnesota, namely seniors in the College of Education (18.8), preflight students (19.4), and army engineers (25.6). Seven schools gave the test to all high-school students. Altho there seemed to be a small gain in achievement from grade to grade in five localities, there was no consistent trend.

Brueckner's original test was timed at sixteen minutes. The senior class of one high school was given an equivalent form one week later and was allowed twenty-five minutes. As a result the mean was raised from 12.5 to 19.6. On the first testing, no marked differentials in achievement in terms of the number of courses of mathematics taken were found except in the case of students who had taken three or more courses. On the second test, a steady rise in the mean occurred with each added course. One group of seniors was given thirty minutes of intensive remedial work for each of four days. This group thereby raised its mean score from 11.8 to 20.1. Brueckner then instituted a similar remedial program for all senior students in another school, and these students raised their mean from 14.0 to 19.3.

Orleans and Saxe (30) prepared a test which covered arithmetic computation, problems dealing with simple business situations, arithmetic information, definitions of business terms, and simple clerical situations. This was given in February 1941, in ten high schools of New York City and in seven other cities, a total of seventy-seven classes and 2281 students being involved. In June, 1460 of the students were retested. The students were enrolled in elementary business training, commercial arithmetic, bookkeeping, or in the academic curriculum. Data on intelligence, achievement, and on the frequency and types of errors made, were extensively reported and analyzed. The interpretations of the authors may be sum-

marized by saying that they regard the achievement shown as low and very unsatisfactory, and they attribute it to a relative lack of understanding or meaning in the prior arithmetical experiences of these students.

Arithmetic in Colleges

Results typical of those found in numerous informal studies were published by Volpel (36). He gave an inventory test including both algebra and arithmetic to sixty freshmen and sophomores in Alma College. His error count shows a wide range of success with the twenty-five different items, but it should be noted that many of the items seem to involve somewhat unusual features. Wilson (38) gave tests on the simplest processes of arithmetic (e.g., addition) to students in Boston University for several years with results showing the need for remedial teaching on the college level. Mohr (28) gave the advanced arithmetic test of the Metropolitan Achievement Test battery to eighth-grade pupils and junior college students in San Francisco. The achievement level of the college students was shown in terms of the percent of correct responses for various types of abilities. Mohr also selected from his subjects a group at each level comparable as to sex, intelligence, and "equivalent age." Data from these groups indicate that four years of instruction in high school, including usually two years of mathematics and one of science, were able only to offset the loss in most arithmetical abilities due to disuse and forgetting. The junior college students had, however, developed significant superiority in the ability to read graphs, handle denominate numbers, do mensuration and geometry, apply percentage, and solve equations.

Orleans and Saxe (29) gave a test of ten verbal problems in commercial arithmetic to students in the School of Business and Civic Administration of the College of the City of New York. They reported data on achievement and errors, and attributed low achievement to lack of familiarity with business computational processes and terminology, lack of appreciation of the reasonableness of a result and the need for checking, and similar factors. They found that for these students arithmetical errors were of relatively minor importance.

Guiler and Rush (22) reported on investigations with 1063 college freshmen and 142 teachers in service, supporting the generalization that extensive arithmetical deficiency exists at these levels. A total of forty-nine students completed a remedial project in less than two months, thereby raising the median score of the group from thirty-four on the initial to forty-six on the final test. Data were reported also in terms of certain specific phases of computation, intelligence level, and error quotients.

The methodology of all of these studies was simple. An arithmetic test was given and the results were analyzed. In some cases auxiliary data in the form of intelligence quotients or courses taken were obtained, and if so the students were classified accordingly and these results analyzed. The recognized limitations of data from a single school led some of the

investigators to extend their populations to include other groups. Data derived from error counts were used extensively. In those cases where the effects of remediation were studied, the conclusions were based on results of a retest. For the most part, the tests used measured computational skills of a simple sort with abstract numbers, and there was little or no discussion of their validity and reliability. In every case the interpretations drawn by the authors implied that in general the level of achievement shown was low or unsatisfactory. These judgments were essentially subjective, since objectively determined norms apparently were nonexistent for the tests used as they were in these studies. It appears that the determination of adequate norms for valid and reliable tests of arithmetical ability at the senior high-school and college levels would be desirable. Such tests would facilitate the selection of students needing remedial treatment, controlled studies of what constitutes an effective remedial program at these levels, and study of the progress of a possible gradual raising of the arithmetical abilities of senior high-school and college students.

Prognosis and Diagnosis

The problem of predicting achievement and related questions has continued to receive attention in recent years, particularly at the junior college level.

Guiler (18) studied the predictive value of the Iowa Algebra Aptitude Test (revised edition), the Christoffersen-Rush-Guiler Analytical Survey Test in Computational Arithmetic, and Form A of the Breslich Algebra Survey Test, all given to seventy-five students in the ninth grade. The criterion was scores on Form B of the Breslich Algebra Survey Test at the close of the first semester. Product-moment coefficients of correlation between the criterion and the other tests were found to be .775, .707, and .731 respectively. The coefficient of multiple correlation between scores on the criterion and the other three tests was .845. Altho these results are high, they were obtained from only one school. Guiler also summarized a number of related studies.

Stein (33) administered the Cooperative Plane Geometry Test, Form R, to 260 students in the eleventh grade at Winnipeg, Canada, and used the scores to divide the group into thirds on the basis of achievement. He also administered other tests (for the most part standardized) to obtain data on twelve traits designated as (a) general intelligence, (b) spatial relationships, (c) linguistic ability, (d) quantitative ability, (e) total score on the ACE psychological examination, (f) arithmetic problem solving ability, (g) arithmetic computational ability, (h) reading comprehension, (i) study habits, (j) logical reasoning ability, (k) symbol manipulation, and (l) teachers' estimates of success. Using analysis of variance technic, he found the differences between the groups on these traits to be, in general, statistically significant at the 1 percent level. In the case of

spatial relationships and study habits, however, the differences between the average and poor achievers were not significant at the 5 percent level. He found that the factors most closely related to success were general intelligence and the ability to manipulate symbols, as in algebra. He found a multiple correlation coefficient of .665 between the estimated criterion scores and the intelligence and algebra factors.

Goddeyne and Nemzek (16) reported on a study of the relative prognostic value of the Lee Test of Geometric Ability and the Orleans Prognosis Test. The chief criterion used was scores on the Cooperative Plane Geometry Achievement Test obtained for 164 parochial students in Detroit. Coefficients of correlation between pretests and criterion were in the neighborhood of .60, and the results tended to favor the Lee test, but by insignificant amounts.

Gere (15) described the construction and use of a mathematics placement test for the junior college level. Cox (10) and Harper (23) described the testing program used for guidance at the University of Nebraska, reporting coefficients of correlation between scores on the classification examination and the final examination, and also between the former and course marks, as well as certain additional data showing the distribution of scores on the same final examination taken by students taught in different ability groups determined on the basis of the pretest.

Vaughn (35) investigated the value of a scholastic aptitude test developed by Crawford at Yale when used to predict success in colleges of engineering. The part of the test designed to measure mathematical aptitude was found to correlate higher than any other with the freshman average grade, yielding a coefficient of .51 for 643 cases. There was, however, rather wide variability among several different institutions. In a later progress report (34) he discussed the prognostic value of certain new preengineering inventory tests compared with the psychological examination of the American Council on Education. He obtained multiple coefficients of correlation of .69 and .67 at two different institutions between the new tests and grade point averages, and his data indicated that for this purpose the new tests are superior to the ACE examination. He also exhibited in tabular form the positive relation of the scores to the number of half-years of mathematics studied in high school.

Kassock (26) described work in placement at the University of Oregon using multiple regression equations with as many as five independent variables. The use of a resulting placement chart reduced the drop-outs or changes of courses after registration from 29 to 9 percent. A discussion of a program developed since 1927 at Iowa State College was reported by Robertson (31). He published placement test items and data associated with each obtained from 704 students in 1941. Using a linear multiple regression equation, he found that 44.6 percent of the predicted scores agreed with the obtained scores, while 84.5 percent either agreed or differed by at most one letter grade.

Keller, Shreve, and Remmers (25) continued their diagnostic testing program at Purdue University and reported on some of the results. They compared scores obtained from experimental and control groups of 130 or more students each. Both groups were given the same tests, including a psychological examination, the Iowa Mathematics Training Test, the Keller-Shreve-Remmers Number Technique Test, the Purdue Mathematics Training Test, and eight achievement tests in trigonometry. The groups were shown to be quite comparable at the beginning of the course in trigonometry. The experimental group, however, was given seven periods of remedial instruction in algebra. They were then given tests equivalent to the preliminary tests in difficulty and type of material, and the mean gain was found to be approximately 40 percent. Moreover, the mean scores of the experimental group on five of the eight trigonometry tests were higher by an amount significant at the 5 percent level in one case, and at the 1 percent level in the other four cases. On three of the tests the differences were not significant. In terms of the distribution of semester grades the results also clearly favored the experimental group.

The evidences of continued interest in prediction and guidance at the college level are encouraging, but the results of many studies by correlation methods suggest that further progress in this direction will depend upon studies of personality factors which may prove difficult to quantify.

General Mathematics in Colleges

The most comprehensive study to date of the general mathematics movement in colleges was completed by Brown (6). He made a survey of the pertinent literature, secured questionnaire results from 458 colleges offering general mathematics in the United States, analyzed more than fifty general mathematics textbooks, recorded observations of fifty classroom recitations, and analyzed opinions of 1500 students enrolled in classes. He traced the development of courses of this type since about 1892 and commented upon several factors influencing it. He found that the objectives of general mathematics as indicated by (a) committees of specialists in the field, (b) authors of the textbooks, and (c) teachers of the subject fall into three categories. The purposes of one group are college preparatory in nature; the aims of another group concern the cultural and social development of the individual; in the third group the objectives include a combination of these two functions. Brown investigated the provisions made to meet these objectives and found that in both the preparatory and the cultural-preparatory courses the content, style of presentation, and emphasis given to topics were substantially identical, but these differed markedly from the offerings in the cultural type. In evaluating the success of these courses, he found that in general (a) the objectives of the preparatory type are largely being realized, (b) the realization of the dual aims and purposes of the cultural-preparatory type are being seriously questioned, and (c) cultural general mathematics, while not entirely

satisfactory, is more nearly meeting the needs of the terminal students in mathematics than the traditional offerings.

Miscellaneous Studies at the College Level

Barnes (1) investigated the effect of the study of eight or more semester hours of college mathematics on the scores of the ACE psychological examination. He found no significant differences in test scores between forty such students and seventy-five other students who had completed two years of work without taking college mathematics. Erskine (13) discussed the use of an index number for evaluating the results of one teacher with different classes (or of a department) in terms of successes and failures made by students on individual test items. Bergen (3) published data on the relative achievement of engineering and other students judged by letter grades obtained in different courses. His data indicated that the liberal arts students in one junior college, altho they had the least previous experience with mathematics, made the best records in college mathematics courses taken in common by students of various curriculums. No data were given on differentials in general ability which may have existed among the groups in the several curriculums. Hassler (24) described a study of the grades of 677 students in the second semester of calculus who had taken the first semester under eleven different instructors. He showed that whether the teacher was the same or different for both semesters made a negligible difference in the grades received.

Bennett (2) compiled data on 7208 high-school graduates who were enrolled in the college of education of Ohio State University. The period covered extended from 1883 to 1943, and after the year 1920 samples of 250 or more cases were used. There was only a slight decline in the percent of students who had taken algebra, but there was a much sharper downward trend in geometry. Of 769 graduates of 1920 or earlier, 745 or 96.9 percent had taken some geometry in high school. By 1943, the percent had dropped to eighty. There was also a definite tendency to take a smaller number of units of mathematics in high school. Bennett regarded the gradual reduction of entrance requirements which occurred during this period as a co-variant rather than a causal factor of the decline.

Interests and Attitudes

Fortune Magazine (14) published results of a survey of opinion among high-school students. The data indicated that mathematics courses were liked *best* among high-school courses by a higher percent of students than was found for any other field, and also these courses were liked *least* by a higher percent of students. It also appeared that those disliking English, languages, and history are devoted to mathematics and the laboratory sciences, and vice versa.

An interesting study of the relationship between attitude and achievement was reported by Billig (4). He secured essay responses of an atti-

tudinal nature from students in commercial arithmetic. He divided his ninety-two usable cases into three groups on the basis of their "term average" in the course, and found a statistically significant positive relationship between favorable attitude and achievement. He used fifteen judges to classify student statements and developed a scale for measuring attitude toward arithmetic which has potential usefulness in guidance.

Controlled Studies of Curriculum Modifications

Willits (37) gave an excellent analysis of objectives of ninth-grade mathematics in the light of modern conditions and centered upon problem solving as the major ability to be developed. He also described an experimental study in which one group of about forty students of average ability was given a course in which the usual logical organization of mathematical content was replaced by a set of twenty-four more general problem situations. Instruction was focused upon the process of problem solving, including the analysis of the situation, the collection and analysis of data, the drawing of conclusions, the making of generalizations, and similar aspects. Mathematical abilities developed included the recognition of and the expression of quantitative relationships by verbal statements, tables, graphs, formulas, and associated concepts and skills. A second group of about the same size, slightly superior in general intelligence and arithmetic ability, was used as a comparison group. These students took the regular course of study in algebra under another instructor. The Columbia Research Bureau Algebra Test was given to both groups, and it appeared that the first group had developed a slightly better than average ability to solve verbal problems at a slight sacrifice in ability to handle mechanical aspects of algebra covered by the test. Willits also prepared a test to measure certain abilities more closely associated with problem solving. This test was given as both a pretest and a final test. Differences between the means for the two groups were not significant on either the pretest or the final test. However, the mean gain of the experimental group was significant at the 1 percent level, but the small mean gain of the control group was not significant. Data on the interest of both groups of pupils in mathematics showed that the experimental group gained and the comparison group lost interest during the year.

Cook (9) described a one-semester study of the teaching of logical reasoning in connection with plane geometry, using nongeometric reasoning situations. One group of 326 students under eight teachers was given the modified course, while another group of seventy-six pupils under three different teachers followed the usual classroom procedure. Data on intelligence and from a pretest battery covering five aspects of logical reasoning showed the groups to be initially comparable. The mean of the experimental group on the final test exceeded that of the control group by an appreciable amount, but data on which to judge the statistical significance of the differences were not reported. Both groups were given an

achievement test in plane geometry with a total score of 193 points. Altho the difference of the means favoring the experimental group (mean, 137.8) and the control group (mean, 136.5) may or may not be statistically significant, it seems evident that in this study the allocation of approximately one-fourth of the time to nongeometric material had no adverse effect on geometric achievement.

Shaw (32) set up two equated sections in ninth-grade general mathematics on the basis of intelligence and first semester achievement. With one section he used goal sheets on which students copied the goals for each unit and checked them off as progress was made. Scores from five tests showed superior gains were made by this group, and there were indications that students of lower intelligence profited more than others.

An Important Curriculum Report

A committee of the U. S. Office of Education (27) which worked in conjunction with the Civilian Preinduction Training Branch issued a significant report on essential mathematics for minimum army needs. This report was based on a checklist which was used to obtain reactions from ninety-six training officers during informal conferences, and item-by-item checks from 178 officers serving as instructors in basic training. The mathematics outlined in the report was thus that actually needed by nearly all men in basic training. The report also contained an excellent discussion of the point of view and the emphasis to be followed, stressing the role of applications and the importance of meaning. Finally, it contained a set of specific suggestions with respect to instruction and advice relative to setting up the instructional program.

Studies of Concepts, Vocabulary, and Equipment

Cronbach (11) prepared a test in which each of fifty-five true-false items dealt in some way with the function concept. He obtained responses on this test from a representative group of forty-one teachers of mathematics and analyzed the results. He found considerable variation and some inconsistencies among the teachers with respect to their acceptance of various subconcepts or aspects of the major concept.

Curtis (12) reported on the mathematical vocabulary used in science textbooks. Difficult words were defined as those not in the first 6000 of Thorndike's 20,000 word list. A criterion containing six descriptions was used to identify the *mathematical* terms from more extensive lists taken in previous studies from thirty-three textbooks of science. By far the larger number was found in physics, where the average number of different difficult mathematics terms in nine books was 159, which was 11.3 percent of the average number of difficult words per book. Curtis also gave a list of the difficult terms occurring on an average of three or more times per book, or which occurred in half or more of the books.

Gorman (17) prepared a checklist of seventy-five items of equipment suggested in books and other sources for use in mathematics classrooms.

He obtained opinions from thirty-two authorities on the teaching of mathematics concerning the desirability of each item. He found that at the senior high-school level sixty-seven items were considered highly important or desirable by the majority of the authorities.

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CHAPTER VII

Teacher Education in the Natural Sciences and Mathematics

ELSA MARIE MEDER

THE emphases that seem to pervade recent reports of studies in teacher education, both general studies and those concerned specifically with the education of teachers of science and mathematics, are on the importance of continuity in teacher preparation and growth, the necessity for integration of experiences in teacher education, the study of the community, and the function of the teacher as an agent of community betterment.

These emphases are obviously interrelated. A concept of education as a continuous process involves a realization of the interdependence and interaction of all experiences. The integration of their experiences can be done only by those who are undergoing them. People need help in achieving such integration, and the study of the community is being found effective as a means of organizing experiences. Community study necessarily raises the questions of community improvement and the responsibility for it.

The Need for Continuity

The report of the National Committee on Science Teaching (18), gave evidence of the difficulty of identifying a line of demarcation between preservice and in-service teacher education in science. In a pamphlet publication of the Commission on Teacher Education, Evenden (11) pointed out a growing recognition of the continuous nature of the teacher education process which is leading to fundamental changes in curriculums for prospective teachers and in educational programs for those already teaching. He stated also that during the last two decades there has been a much greater and more rapid increase in the quantities and kinds of knowledge and skills considered important for teachers than in the length of the preparatory period. Consequently much that is important has had to be postponed from the preservice to the in-service period of teacher education. Evenden indicated further that as a result of the war, new demands have been made on teachers, requiring many sorts of adjustments and calling attention to the need for more effective preparation and for better provisions for growth while teaching.

There is documentation of such need in the statement of purposes of the commission (9). A summary of the characteristics of the teaching profession—actual and prospective—revealed that altho the median age of teachers is probably still below thirty-five years, the average age is steadily increasing. This finding led to the conclusion that not only should prospective teachers be afforded an excellent and extended education,

but that teachers in service for many years should be aided to grow in professional competence.

This volume also contains an analysis, based upon study of American life and ideals, of the qualities desirable for teachers in America. The analysis was presented as having implications for the organization and curriculums of colleges preparing students to teach and for the fostering of continuous professional development after graduation.

In its report on the in-service education of teachers (19), the commission defined the continued education of teachers as steady growth in the capacity to teach, broadened understanding of human development and human living, and growth in the capacity to work with other people—classroom teachers, administrators, parents, community leaders, and children of various ages. Armstrong, Davis, and Hollis (3), reporting procedures in the colleges and universities associated in the cooperative study of the Commission on Teacher Education, concluded that teacher education is legitimately concerned with everything about the individual from the time he decides to prepare for teaching, during every stage of his preservice experience, and thruout his period of activity in the profession. They predicted increasing attention to in-service teacher education in the immediate future. They found, furthermore, that an institution that attempts to serve active teachers is likely to find demonstrable improvement in its programs of preservice education.

A general conclusion from the two studies just cited was that, altho excellence in teacher preparation is and will continue to be essential, its fruition in effective teaching depends to a significant extent on the opportunity and challenge that inhere in the school situation.

Attempts To Promote Continuity

For continuity in teacher education to be realized, the gap between the thinking of school personnel and college people must be decreased. The two groups have not in the past recognized their common interests. The first step toward such recognition has been the cooperation between college departments of education and active teachers in the directing of the practice teaching experiences of prospective teachers. The report, *The College and Teacher Education* (3), contains instances in which school and college instructors have become aware of their mutual concern with teacher education. For example, the faculties of Washington State College and Eastern Washington College of Education were interested in working in the summer workshops of the Spokane school system because for many years their education students had been observing and practicing in the Spokane schools. Following the first workshop experience, a committee consisting of both school and college people undertook the revision of the college extension courses to fit them more closely to the educational needs of the teachers for whom they were offered.

Since December 1938, the University of Nebraska has been carrying on experimental work designed to further the professional development of

active teachers. Group work has been conducted in in-service education centers by a university coordinator, whose task it is to bring such resources as the services of experts, books, and equipment to bear on the needs of the teachers in attendance at each center. The report revealed that the Nebraska program ramifies widely and significantly thruout the state, and that not only does it serve active teachers and local communities, but thru it campus courses for prospective teachers are becoming more meaningful and preservice education is gaining in vitality.

Integration of Experiences

Evenden's survey (11) showed a perceptible tendency on the part of educators to recognize education, and therefore teacher preparation, as dealing with large related areas of experience rather than as consisting of credit hours of physics, mathematics, history, and the like. Some educators were found to be thinking in terms of subjectmatter groupings such as the humanities, the arts, the sciences, and the language arts; others to believe that all organized bodies of knowledge are properly conceived as resources to be drawn upon in preparing people to live with satisfaction to themselves and to society. Evenden stated, however, that integrations of this kind have not yet been incorporated to any great extent into programs for the preparation of teachers.

Progress Toward Integration

The Columbia University Cooperative Program (12) was planned to progress toward integration. Three approaches were used. The first was that of developing a close relationship between professional education and liberal arts study. This approach had two aspects: (a) that of helping the student become aware and critical of his own educational experiences, whether in or out of school, and (b) that of providing him with firsthand acquaintance with the problems and possibilities of the work of the teacher. The second approach was that of working out a meaningful continuity among the various elements of professional education. Courses in education are frequently at least as unitary as courses in any of the liberal arts, and as a result may be highly theoretical and remote from actual teaching problems. The third approach was thru the establishment of an effective relationship between undergraduate work and the graduate study which immediately followed it in the program.

The Columbia University program was carefully evaluated during its three-year demonstration period. Among the results which were convincingly established were gains in the integration of the various phases of teacher preparation, including subject fields and areas of professional education.

A program for the preparation of teachers at Syracuse University (8) was set up on three basic principles: (a) that theory and practice should be integrated at every step of the learning process, (b) that subjectmatter should be selected in terms of clearly defined objectives and should be

integrated around concrete problems, and (c) that a wide range of learning activities should be included in the preservice curriculum. The science program that took its departure from these principles required the prospective science teacher to acquire first a background of liberal arts study in which the work in science was distributed among botany, zoology, chemistry, physics, and geology. Professional study of science education was built upon this background and was concerned with the character and function of science materials, the development of teaching materials, the presentation of teaching materials, and the evaluation of teaching outcomes.

The Syracuse University program was frankly experimental. Those responsible for it and those who studied it from without concluded that it was sound as to basic principles and general directions, and that all the evidence accumulated indicated its marked superiority over the former more traditional program.

At the Wisconsin State Teachers College at Milwaukee, it was felt that the existing program failed to provide for the general cultural development of the students, a failure believed to result in large measure from a lack of integration of subjectmatter. An "area curriculum" was therefore set up, which consisted of required broad-fields courses in the junior college years. One of the areas was that of the physical sciences, another that of the biological sciences. An account of the development of the area course in the physical sciences is included in a report of the Commission on Teacher Education (3). The course attempted to integrate the fields of physics, chemistry, mathematics, geology, and astronomy. At first the staff divided the time allotted among the several subjectmatter fields, selecting titles for the year's lectures and arranging these in logical sequence. The attempt to integrate the work was made by dividing the class into discussion sections, each with a staff member as leader. As the work progressed, the focus of integration came to be seen in the life purposes of the individual students, and changes were made in the direction of greater student participation.

One of the checks on the work of the area courses was the administration of the Cooperative General Culture Test to matched groups of students in the area curriculum and in the traditional curriculum. The average scores on the total test were at the 78th percentile for the experimental group and at the 65th percentile for the control group. The experimental group consistently outranked the control group on all subdivisions of the test: in science, the rankings were 82 and 54, respectively, and in mathematics they were 64 and 54. When the test was repeated with new matched groups the next year, similar results were obtained.

Studying and Serving the Community

The fundamental role of education is to integrate the student with his community and to acquaint him with what is known. It is therefore no innovation in educational theory to recommend that teachers possess

knowledge of facts about communities and of methods of getting such facts, as well as some desire to use them for the welfare of human beings. Stress on community study in programs for the education of teachers is, however, relatively new.

There is a great body of information, pertinent to community improvement, with which teachers and students are yet unacquainted. Ivey (14), reporting for the Southern Committee on Regional Study and Education, indicated the importance and nature of southern regional resource education, and appraised existing sources and methods. He concluded that an amazing development of the South is possible thru general understanding and participation, that a wealth of material is available for use, and that this material must be integrated by state and regional agencies. The results of modern research in the physical, natural, and social sciences can be brought into the schools and thru them into the communities. But this can be accomplished only when the teachers in the schools are interested and are able to develop and use new technics. Any effort to translate research for public-school use depends on the abilities, knowledge, and attitudes of the classroom teachers. Ivey concluded that for teachers to utilize more effectively the community resources available to them, there must be new procedures in preservice education and new emphases in in-service programs.

Procedures for Preservice Community Study

Two recent reports suggested procedures for preservice community study. Dunlap (10) analyzed ways in which prospective teachers may explore communities served by the schools in which they observe and practice, and the means by which individual guidance during student teaching experience may point up the opportunities for teachers to become functioning members of their communities. Richardson (20) proposed for prospective science teachers an extended series of experiences and studies directed toward an understanding of school and community relationships and problems and competence in dealing with them. The experiences were chosen in the light of the students' backgrounds and of the types of communities into which they go to teach.

Community Study by Active Teachers

The Commission on Teacher Education collected and interpreted reports of community study by experienced teachers. One report, included in *The College and Teacher Education* (3), described work in a Nebraska center, where evaluation of the curriculum in a town of 360 inhabitants had revealed a marked deficiency in the health program. To change this situation, the school first brought the problem to the attention of the community, working thru the parents' organization and the local press. Study units in health were planned by students and teachers together. Annual health examinations of all pupils were introduced. The entire community became health conscious.

Prall and Cushman (19) discussed at some length a countywide study of community problems, which was carried out cooperatively by teachers in Colquit County and Moultrie, Georgia. Eight working groups were organized, three dealing with health (control of hookworm, typhus fever, venereal disease, and dental decay), three with recreation, and two with studies of homes and housing. The descriptions of their activities revealed two general pervading purposes: a relatively continuous desire to improve health conditions and to make local living more attractive and satisfying, and an effort to see more clearly how to meet the needs of their students. They revealed also the effectiveness of the three-year project in improving community conditions; in changing curriculum procedures, teaching methods, and educational philosophies; in increasing social understanding; and in providing for the practice of individual initiative.

Another cooperative program of community study was reported from Des Moines, a program which was carried on simultaneously in several directions. Prall and Cushman (19) called attention to five of its features: (a) the work was conducted in such a way as to foster the emergence of new ideas; (b) new groups were encouraged to start work on an independent basis, but these quickly joined in with the general program; (c) responsibility for the several projects was delegated to subcommittees of the large planning committee; (d) the role of lay leaders was as important as that of school people, and both groups came to see the city's agencies as partners in the education of youth; (e) the school administration followed the policy of leaving the project to the initiative and leadership of classroom teachers and laymen while maintaining an active interest in developments. The next step in the Des Moines program was seen to be the task of educating teachers and the people of the community generally to the possibilities of pupil participation in community study and curriculum planning.

Such cooperative programs are evidence of the stimulation of group thinking and its culmination in group action. Other instances of group thought and action in programs for teacher preparation and teacher growth were reported by Study (21), Carothers (7), and Armstrong (2). Another case in point is a community study conducted in Indianapolis as a project of the Arsenal Technical High School (5, 13). Particular attention was given to the implications of the study for science teachers, which led to changes in the direction of broadening the science offerings of the school.

Extending the Education of Science Teachers

A long-term project for improving the education of science teachers was conducted by the Bureau of Educational Research in Science of Teachers College, Columbia University (4, 5, 6, 17). Beginning in 1939, workshops for science teachers were held each summer; the first marked the beginning of a period of cooperation between the bureau and certain of the

schools represented by the participants. The representatives of these schools brought their problems to succeeding workshops. Members of the bureau visited the schools during the academic sessions, advised with administrative and supervisory officers and with teachers, and assisted with the initiation and development of new procedures. The workshops represented an effort to supply experienced science teachers with opportunity for continued personal growth and professional development, to make it possible for such teachers to meet and share experiences with others who teach at different levels, who have specialized in other sciences, and who come from different regions.

These workshops operated on the assumption that community study, together with study directed toward an understanding of the youth to be taught, affords a sound basis for the exploration of the several fields of scientific knowledge to identify information pertinent to understanding and attacking people's problems. During 1943, such exploration was concerned with aspects of the physical sciences related to housing and to specialized training for war service, and with aspects of the biological sciences pertaining to human nutrition, communicable diseases, and interracial relations. In the 1944 workshop, emphasis was on scientific knowledge in its relation to the technological use of materials and energy and to technological developments affecting agricultural production. There were three recognized aims: (a) to help the participants develop a philosophy of science teaching in accord with the emerging aims of general education; (b) to help them become aware of the place of science in society; and (c) to help them make their knowledge a part of their working equipment. Evaluation by the members indicated progress toward each of these goals (6).

Proposals for the Education of Science Teachers

At the University of Texas committees were established to work on appropriate curriculums for high-school teachers in several areas, including the areas of natural science and mathematics. The report of the mathematics committee, which was appointed later than that on the natural sciences, has not yet been made generally available. The report of the committee on the natural sciences was summarized in *The College and Teacher Education* (3). This committee consisted of the deans of the college of arts and sciences and the school of education, and professors of botany, chemistry, geology, physics, zoology, and secondary education. Its first activity was a survey of conditions in high schools, which brought out the facts that, of the 1800 active science teachers in Texas, nearly half were in schools enrolling fewer than 150 students, and that a typical teaching schedule included courses in general science, biology, chemistry, physics, and mathematics or history.

Altho the committee members seriously considered the possibility of establishing broad courses in the physical, biological, and earth sciences

for prospective teachers, they finally proposed instead a curriculum emphasizing a greater range and less concentration in special subjectmatter courses than they had previously obtained to the end that each science teacher would have an acquaintance with five sciences, a fuller knowledge of two of these, and further work in one. They also recommended the establishment of a seminar on teaching the natural sciences, to be concerned with integration and synthesis of the several sciences for purposes of secondary-school teaching. This synthesizing seminar was to be conducted by a specialist in science education who would also direct the long-term task of revising specific science courses and serve as liaison officer between high-school and university personnel.

Working at Ohio State University, Richardson (20) secured objectives for the preparation of science teachers (a) from a considered statement of a philosophy of education, including a discussion of the psychology of learning; (b) from a synthesis of opinions of experts relative to the education of science teachers; and (c) from an examination of the present scene in science teaching, including trends in enrolment, organization of textbooks and laboratory manuals, and preparation and information of science teachers. He made a survey of experimental approaches to teacher education and developed an interpretation, in terms of science teaching, of "factors in competency for teachers" prepared by leaders in Ohio education. Out of this background, Richardson proposed a general plan of college curriculum organization and functioning having five areas: personality development, professional competency, community study, general science information, and special science knowledge. The area of general science was concerned primarily with the development of a comprehensive world picture and of understandings of science applications in daily living. The area of special science was organized in terms of "functional units," such as the conservation of resources and the production of synthetic materials.

Recommendations Relating to Legislation

The Cooperative Committee on Science Teaching (15, 16), composed of representatives of the American Association of Physics Teachers, the American Chemical Society, the Mathematical Association of America, the National Association for Research in Science Teaching, and the Union of Biological Societies, found that the certification requirements for secondary-school science teachers were low with regard to subjectmatter, and that teaching combinations were chaotic and not to be justified on the basis of teachers' preparation. The committee accordingly recommended a policy of certification in closely related subjects, specifically in any three of the following: biological science, chemistry, earth science, mathematics, and physics.

A committee on the Teaching of the Basic Sciences (1) arrived at the following conclusions from a review of the results of recent studies:

(a) there is a conspicuous lack of training in the physical sciences in secondary schools, owing to the fact that more than half these schools have six or fewer teachers; (b) some of the best science teaching in smaller high schools is being done by teachers of agriculture whose time is prorated; and (c) those now teaching science in many states are poorly prepared in their respective subjects. Many teachers were found to teach three, four, or even more subjects which may be almost entirely unrelated, and science teaching often was assigned to individuals for whom science was only a minor subject in college. This situation could be remedied by certification of science teachers in comprehensive areas, such as a combination of the physical sciences with the biological sciences or with mathematics and geography. But teachers trained in such areas are also potential candidates for industrial positions at higher salaries.

The committee proposed, therefore, that existing legislation relating to vocational and technical education be amended and future legislation be formulated to include provision for the sciences (including mathematics) basic to such fields as vocational agriculture, trades and industries, home economics, and distributive occupations. Such provision would have two major effects: (a) standards set up by state departments of education in cooperation with the U. S. Office of Education would have to be met; and (b) since the effectiveness of engineering, technical, and vocational education and training is largely dependent on the quality of preparatory education in mathematics and science, programs of teacher education under acts supplying federal support would have to include provision for the preparation of science and mathematics teachers.

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FOREWORD

THIS is the fourth issue of the Review devoted entirely to a consideration of the general field of research methods and technics and of appraisal in education. The general plan of this issue is patterned on that used in the third cycle published in December 1942. Unfortunately, the plan was not carried out completely. The primary deficiency is the lack of a chapter reviewing the important fields of the logic of research (operationalism, symbolism, and semantics),¹ procedures in reporting research, and the evaluation and implications of research in education.

Rationalization for the deviation between plan and product is too easy. All the contributors carried a heavy burden during the war period. Some, in their capacity as consultants in the war effort, were so overwhelmed by their tasks that they felt that they could not carry to completion the promised reviews. The majority of the promised reviews, however, were completed with the assistance of other reviewers. Particularly, it should be pointed out the Paul Blommers assumed the difficult task of reviewing the recent developments in statistical theory for the period from January 1943 to July 1945.

All other chapters of this issue cover the period from July 1942 to July 1945. The reviews may seem unduly brief. Their brevity is due entirely to space restrictions occasioned by the paper shortage. Whereas the December 1942 issue was allowed 120 pages, the current issue was restricted to about 90 pages.

Research technics and methods, as represented by the three-year cycle, are continuing to develop and expand. Perhaps the area that has developed most rapidly, and sometimes too rapidly for education to keep abreast of it, is the field of statistical methods. The published literature is a rich resource for the research worker in education, but the unpublished advances will be even richer. During the war, great developments have been made in this field. A very significant new development is the work of Wald and his co-workers in the statistical research group at Columbia University on "Sequential Analysis of Statistical Data" both in theory and in applications.² Other developments made in connection with the war effort soon will be published.

It is a pleasure to extend thanks to the committee that planned this issue, and to the contributors who gave reality to the plan.

IRVING LORGE
Chairman

¹ It is significant that the September 1945 number of the *Psychological Review* devotes its entire issue to a "Symposium on Operationalism" [Vol. 52, No. 5, p. 241-94].

² The first publication of this material is in the *Annals of Mathematical Statistics* 16 117-86, June 1945. Other articles will be published in the near future in the same journal.

CHAPTER I

Library Resources and Documentary Research

DOUGLAS E. SCATES

TO PERSONS of direct action who find satisfaction predominantly in the dynamics of face-to-face relations, documents have slight appeal. To persons of deliberative temper, the contents of written records are both the means of order and the basis of progress. The recorded fact and the written communication are not only essential instruments for the avoidance of chaos in a complex society, but they span the reaches of space and time and enable the thinker and the discoverer to transmit carefully observed conditions and thoughtfully developed insights to those who may be at a considerable distance or in a later period. Thus each worker—each generation—is spared the necessity for beginning all over again. Thru documents the isolation of individuals far apart in space or time is changed into opportunity for joint endeavor. We may weary of the multitude of books and the incessant stream of paper, yet we know that in such materials are found the concepts of the present and the hope of the future.

The present chapter, as indeed this entire issue, is given not so much to the products of research as to the means of research. Entries in the bibliography represent for the most part discussions of what should be done or how it should be done, and they refer to finished studies only as examples. The present reviews are therefore somewhat more in the nature of guides to literature than is contemplated for the regular issues of the REVIEW.

The scope of the present chapter is, by assignment, the entire range of technics and procedures appropriate to working with documentary sources. The chapter carries forward the treatment of Good (33) in the December 1942 issue of the REVIEW and that given more extensively in four chapters of the December 1939 issue.

BIBLIOGRAPHICAL AIDS AND LIBRARY RESOURCES

The years of social turmoil, rapid change, and furious activity brought by the war have produced many new facts with which to reckon, many new ideas to be sifted, and many new and unusual documents to be studied. The momentous shifts in the physical and mental world place added emphasis on bibliographical tools; without them, the researcher stands futilely before a mass of material expanding more rapidly than he can work. The field of education is among the most thoroly indexed and summarized of the academic disciplines or the practical arts, yielding place perhaps only to law. Yet these comprehensive and specialized tools are of value only when known about, understood, and used.

General Library Tools

The writer must confess to some tendency to neglect the more general library aids: perhaps because our own education indexes usually offer more than we can immediately utilize; perhaps because the general sources require more searching and selecting; but probably because many of these tools require a degree of maturity in library work which does not come in one's early years. The librarian's professional books and the general reference works often do, however, offer the educator material of stimulating breadth and make him feel the narrowness of his contemplated approach. They would be valuable if they did nothing more; but in some cases they provide the only systematic source of information about material which one seeks, and in most cases they offer additional material.

Indexes—Three new volumes, from the H. W. Wilson Company, bring two series more nearly up to date and extend a third series further back. The *Cumulative Book Index, 1938-1942* (18) constitutes the third permanent supplement to the *United States Catalog*, fourth edition, published in 1928. This cumulation will reduce the number of temporary supplements one must handle. The *Bibliographic Index* has issued its first six-year cumulation (21) covering 1937-1942. The volume has been augmented so that it includes 5000 more bibliographies than appeared originally in the quarterly and annual volumes. Approximately 50,000 bibliographies are listed on 9260 subjects. Twenty-three pages of bibliographies appear under the head, "Education," or "Educational"; two and one-half pages under "Learning, psychology of," etc. As such, the publication keeps Monroe and Shores' *Bibliographies and Summaries in Education* up to date. However, it lacks author entries.

The *Nineteenth Century Readers' Guide, 1890-1899* (26) marks a serviceable and promising venture in extending backwards the general periodical index which has, since 1900, been in widespread use. This new two-volume index covers fifty-one periodicals for the last decade of the nineteenth century, and in addition, indexes fourteen of these beyond 1900 up to the time they were taken into one of the Wilson indexes of the present century. *Education*, the *School Review*, and the National Education Association *Proceedings* are three educational serials which are covered back to 1890. The indexing of earlier decades may be undertaken. While the nineteenth century is regarded as the domain of *Poole's Index to Periodical Literature*, this is so by necessity rather than by right. Poole's index did not use a standard list of subject heads but employed catch titles lumped under large heads; it did not give author entries, provided no cross references, and offered only incomplete bibliographical information.

Ireland issued *An Index to Indexes* (48) which provides a serviceable list of all kinds of indexes to books and periodicals, by subject field.

Indexes to legal literature—The H. W. Wilson Company's *Index to Legal*

Periodicals (1) appeared in a three-year cumulation and in a one-year cumulation during the past triennium. This index appears monthly and extends back to 1908; up thru July 1928 it was published directly by the American Association of Law Libraries. It provides a subject, author, and book review index, and a table of cases. Volume VI of Chipman's *Index to Legal Periodical Literature* (22) continues a subject and author index which dates back to 1886, known as *Jones' Index* up to 1898. The *Legal Periodical Digest* (53), which dates back to 1928, is a loose-leaf publication which cumulates by subject. While it is a digest rather than an index, it provides an index to topics, cases, and authors and thus serves as an index somewhat after the fashion of *Psychological Abstracts*.

General reference works—The second edition of the *Union List of Serials* (42) must be named first among the reference works of the past three years. In conjunction to microfilming, discussed later, this volume should be of greater value even than its predecessor. The list gives library holdings as of January 1941; it covers 650 libraries (three times as many as the first edition, published in 1927, as of January 1925) and 115,000 titles as compared with 75,000 in the first edition. The scope has been broadened to include annual summaries of research and numbered monograph series. Fragmentary listings for Latin-American libraries have been ventured.

Mention should be made of the reproduction, in book form, of the Library of Congress card catalog (11) which is, in August 1945, thru *Rand*, volume 122. The project may be completed within a few months. These volumes, with current supplements, will take the place of the Library of Congress Depository which has formerly been established in a few large centers. Similarly, the *British Museum General Catalogue of Printed Books* is appearing in book form; it has reached *Clau*. Both of these projects are author and title catalogs only; entries are not made by subject.

The United States Quarterly Book List (54) is a new publication, arising from a recommendation of the American Conference for the Maintenance of Peace in 1936 that the Latin-American nations exchange information concerning ideological and technical developments. This list is issued to keep one abreast of current publications in the United States on fine arts, philosophy, the social sciences, biological sciences, technology, and reference works.

In the field of library guides, a new supplement (1941-43) to Mudge and Winchell (56) has been issued. Hutchins (47) has treated reference work in a way that is helpful to individuals seeking information, especially those desiring current statistical information (41: chapter VIII). Brown (17) has issued the fifth edition of a fairly simple outline of library organization and procedure. A part of this has been printed separately as "Shortcuts to Information."

Biographies—A new publication of the A. N. Marquis Company, *Who Was Who in America*, covering 1897-1942 (79) presents biographies of deceased persons formerly included in *Who's Who*. The twenty-third

volume of *Who's Who in America* (80) and the seventh edition of *American Men of Science* (20) have appeared. Current biographies of men in the news continue to be issued by both the A. N. Marquis Company and the H. W. Wilson Company.

Bibliographical Aids in Education and Related Fields

Since in five minutes' time one can get from the *Education Index* more than he knows what to do with, what is the value of delineating a multiplicity of bibliographical methods and sources? To those who are easily satisfied and whose wants are simple, there is no answer; but to those who seek a wealth of resources by which to enjoy the varied facets of a rich quality and broad outlook in their perspective, no single approach will do. Each individual index or reference work has its own particular purpose and makes its unique contribution. Only thru knowing about the available aids can we obtain high satisfaction.

Indexes—The *Education Index* has issued a three-year cumulation (1941-44) and a one-year volume (19) during this period. The *Review of Educational Research* issued a twelve-year index (60) covering 1931-42. Heretofore workers have had to depend on annual indexes which did not maintain a consistent set of subject heads; and the index for 1936 was lacking. An annual index on business education (31) has been prepared since 1940; it is represented as covering thirty-four periodicals thoroly, 110 selectively, and including 3800 items. Workers in the social studies will welcome the 1941-44 supplement to the index of the *National Geographic Magazine* (58), the permanent index covering 1899-1940.

An index to abstracts of psychological literature of an earlier date (1894-1928) was prepared by Ansbacher (10). This work was incidental to a larger indexing project in psychology which was never finished and appears to have been abandoned. The larger project planned for an adequate and detailed topical indexing of the former *Psychological Index* which grouped references only by comparatively large heads. The incidental project was the finding of abstracts for the original articles which the *Psychological Index* covered; abstracts were found for about half of the articles, and these abstracts are now themselves keyed to the original *Psychological Index*. These abstracts are particularly valuable where they happen to be more accessible than were the original journals, as for many foreign publications.

Thesis lists—The annual *Bibliography of Research Studies in Education* prepared by the U. S. Office of Education was discontinued with the 1941 issue (covering 1939-40) for the duration of the war; policy with regard to resumption has not been announced, but the Office is continuing to gather data on completed master's and doctor's theses. Good (34) has continued to list doctor's theses under way and Henry (44), following Gilchrist's earlier editorship, has listed those accepted in all fields. Blackwell (14) gave a twenty-five year list for certain educational subjects

in England. Theses under way in sociology are listed annually (7) as are those which have been accepted for degrees (6). Knox (51) listed theses on Negro education.

Booklists—A list of practically all the books and monographs published on education is prepared each year by the Enoch Pratt Free Library of Baltimore (76,77). From these the sixty most outstanding books are selected (43). For the past three years, sixty books could not be found for the purpose, and the list has contained only 32, 52, and 34 books, respectively.

Special Bibliographies and Summaries of Educational Subjects

A number of bibliographies and summaries relate to certain areas or phases of education. Such bibliographies are correctly the responsibility of those reviewing the individual areas in which they fall; but bibliographies are also the province of the general bibliographer, and it seems appropriate to mention here those which appear to be significant. The areas covered are: business education research (30); child development (40); current status of education (36, 37); curriculum making (52); employment tests (12); health research (25); modern language teaching (55, 61, 69, 71); Negro education (50, 59); physical education (25); reading (9, 13, 36, 41); school buildings (68); sociological research (15, 16). "Selected References" on twenty phases of education have continued in the *Elementary School Journal* and the *School Review*.

Research methodology—Smith (67) published a new text in this field, and Whitney's text (78) went thru another printing with slight alterations. Good has continued his annual bibliography on research methods (39) and has also published two reviews of treatises in this area (38). Shannon and Kittle (118) analyzed the contents of eight texts on research methods in education. Section 30 of the general list of education books (76, 77) is devoted to research and general bibliographical aids. Sarton (65) offered a critical bibliography of the history and philosophy of science.

Guides to Educational Films

Bibliographies of educational motion pictures have not previously been given in corresponding treatments of the REVIEW, but this medium of recording and of instruction is now so widespread that to ignore it further is quite inexcusable. Films both represent research and are the subject of research. They have value just as truly as the printed word.

The H. W. Wilson Company's *Educational Film Catalog* is now issued monthly, beginning with January 1945. The name of the annual publication has been changed to *Educational Film Guide* (24). The latest edition lists 4300 films by subject, most of them having annotations. The largest single guide to educational films is the encyclopedia published by the

American Council on Education (5). This was prepared by the Committee on Motion Pictures in Education, under the direction of Charles F. Hoban, Jr., and represents some three years of cooperative work in selection and evaluation. Nearly a page is given to the description and rating of each film. A war supplement was issued (3). Other guides have been prepared (27, 46). The United Nations (29), Latin America (4), and vocational training (75) are covered in special indexes. Several states which maintain state film libraries have issued catalogs for use thruout their school systems.

Hoban (45) discussed sources of information on films and how to use these sources. The National Council of Teachers of Mathematics (57) discussed "multi-sensory" aids and listed certain films. The following magazines have current sections listing films: *Educational Screen*, *Journal of Business Education*, *Nation's Schools*, *Scholastic*, and *School Management*. Other guides will be found in the *Education Index* under the topic "Moving Pictures—Catalogs."

Reference Works for Educators

Dictionaries and encyclopedias—The *Dictionary of Education* (35) defining 16,000 terms, sponsored by Phi Delta Kappa and edited by Good has appeared. Active work has been under way for six years; a large number of persons, including many from the American Educational Research Association, participated in it. A *Dictionary of Sociology* (28) and two encyclopedias have been issued—the *Encyclopædia of Modern Education* (63) and the *Encyclopedia of Child Guidance* (83). Thompson (72) prepared a *Glossary of Library Terms*.

Biographical directories—The eleventh edition of *Who's Who in American Education* (81) and a *Who's Who in Philosophy* (64) were published. For the many other directories which have been issued, one is referred to the topic "Directories, Educational" in the *Education Index*.

Publication Changes: New Magazines; U. S. Office of Education Reports

New periodicals—Among the resources of the library of immediate interest to educators are several new or changed periodicals. The Society for the Psychological Study of Social Issues, which has heretofore published its bulletin, began the *Journal of Social Issues* (69), a quarterly, in February 1945. Whereas its previous bulletin contained technical research, the new one is designed to get findings of social research understood by field workers in education, government, industry, and social work. The *American Vocational Journal* (9) began as a monthly in January 1945, replacing the quarterly *American Vocational Association Journal* and their *News Bulletin*. *Higher Education* (74) began in February as a new semi-monthly medium of communication between the

Higher Education Division of the U. S. Office of Education and the field. *Biometrics Bulletin* (8) began in February 1945, covering the application of statistical methods to problems of growth.

U. S. Office of Education reports—Considerable curtailment in reports of basic data has occurred during the war. Many data now available are old; e. g., there has been no report on subject registrations in high school since 1933-34. At the time of writing the *1938-40 Biennial Survey of Education* had not been published. When it appears, it will be a dual volume, combining both the 1938-40 and 1940-42 surveys. This combining, forced by the paper shortage and by budgetary limitations of the Office, means the loss of more than half of the material normally published, for the combined volume is expected to be smaller than the usual single volume. Tabulation of the next survey, for 1942-44, has started.

For 1946 some expansion of the statistical function of the Office of Education is planned, in the form of a new statistical research service. This service is to be one section of a new division of central office services.

Microfilming: New Epoch in Research Resources

In this day of frenzied development, crowded with announcements of startling inventions which promise to change our ways of living in so many respects, one wearies of fantastic suggestions of the length to which new devices may carry us. But already actual practice in a number of lines has equalled the wildest dreams of a few years ago. The danger, with respect to microfilming, does not seem to be that too much shall be expected but rather that too little shall be executed—that we shall be bound by inertia to ways of great waste for years after technical developments have been ready for use.

Rider (62), librarian at Wesleyan University, Connecticut, points out that at present a book of 250 pages can be reproduced on the back of one 3x5 catalog card, and with slight advances in technic, 500 pages could be recorded on one side of a card. The front of the card would be reserved for a description and abstract in normal sized type. Rider does not suggest doing away with all books, as most of us like full-sized books; but he does recommend that the reductions be employed extensively by research libraries, where the expansion in recent years has been astounding and where the costs have been excessive. He analyzes the four main costs of a library—purchase of documents, cataloging, binding, and storage (building and equipment), and shows that micro-cards would afford relief. But the main advantage of micro-cards would be to the user—the material he seeks would be *in* the card catalog. Call numbers would disappear; even general indexes to periodicals would be unnecessary as the periodicals would be reproduced article by article and each filed under its own subject in the card catalog.

Rider believes that microfilming represents a greater step forward than did the change from papyri to flat books, and that we are at the

beginning of a new era in library services to the research worker. He states:

Is it possible, whether we realize it or not, that we are approaching the end of an era in our library methodology? It is now sixty or seventy years since, under the compelling assurance of Dewey and Cutter and Poole and their fellow pioneers, the library world crystallized a definite pattern of library technique, which, although it has been greatly amplified and refined, has never been basically changed. There has even been a tendency in some library circles to take it for granted that it was a final technique. But no technology is ever final or finished. (62: 84)

Fussler (32), head of the department of photographic reproduction, University of Chicago Libraries, wrote about the usual library uses of microfilm for condensation, preservation, and acquisition (as where books are out of print). The research worker is primarily interested in the reproduction service which makes all material in any library available to him without the expense of travel. A number of the large libraries now render this service regularly; the cost varies with the policy and with the length of material photographed. At the University of Chicago or at the Library of Congress, the cost of reproducing a 500-page book is about one cent per page. Shorter material may run three or four cents per page. But where several films are made from the same book for distribution to several libraries the cost is about one-fourth cent per page and may run as low as one-tenth cent.

Three supplements to the *Union List of Microfilms*, originally published in 1942, have been issued (73), bringing the number of microfilms listed to nearly 15,000. Cibella (23) reported briefly on the history of microfilming, noting a strong impetus in the middle thirties. Shaw (66) reported cost studies within the range already mentioned.

Of the more than sixty references on microfilming of the past three years four (2, 49, 70, 82) will suggest the wide variety of current uses by libraries, municipal state and federal governments, business, and the Army. Many articles are found in the *Library Quarterly*, the *Library Journal*, and the *Journal of Documentary Reproduction*. The last named was started in 1938 by the American Library Association but was discontinued during the war. For those who wish to pursue the subject, references will be found under the topics "Microfilms," "Microphotography," "Microprojectors," and "Books—photographic reproduction and projection," in the *Education Index*, *Readers' Guide*, *International Index*, and *Industrial Arts Index*.

The Joint Committee on Materials for Research was formed in the early thirties by the American Council of Learned Societies and the Social Science Research Council, with Robert C. Binkley as chairman (his *Manual* was listed in the 1942 REVIEW). The committee was dissolved recently, following the death of its chairman, but it saw many of its ideas and hopes being carried out by the Work Projects Administration Historical Records Survey Project (103), the W. P. A. Project for a Survey

of Federal Archives outside the District of Columbia, and by the committee of the American Historical Association concerned with source materials. The files of the Joint Committee have been placed with the American Council of Learned Societies (1219 Sixteenth St. N W., Washington, D. C.).

DOCUMENTARY RESEARCH

Historiography: the Production of Written History

Rubin (114) outlined some of the services which statistics can render to historical research. In addition to the simpler, direct uses of statistics (92, 112) he pointed out possibilities for sampling, testing theories by statistical means, the use of probability in the identification of manuscripts (external criticism), and the detection of trends. Statistics was born among the social sciences; among them it has a future of great opportunity.

Zucker (125) prepared an extended American history advertised as "the science of history . . . the now-identified fundamental laws by which the past can be directly interpreted through cause and effect." Such is the aim of every historical writer; the degree to which Zucker has achieved the aim can be judged after a study of his work by those interested in the fundamental problem of historical interpretation. MacIver (107) discussed social causation at some length from the sociological point of view. He noted the shortcomings of contemporary social science and the weaknesses of statistical studies and of operationalism. He argued for causes which were actually meaningful in the lives of the individuals involved (p. 391).

Saunders (115) discussed historical scholarship—the current training of historians for research. Gottschalk (97) and Kidder (103) dwelt on historical sources, the latter delineating in considerable detail the contribution of the Historical Records Survey. Martz and Smith (108) have published source material on the history of education in Indiana, dealing with the territorial period. This publication is the first part of a long-term project of gathering and publishing copies of original records concerning early education in the state. Documentary reproduction, treated in the preceding section, must be considered in connection with source materials. Fruitful references, both on sources and on history writing, will be found in the *Readers' Guide* under such topics as: "Archives—United States," "Historical Research," "History—Historiography," and "World War, 1939—Historiography."

Historical Research Studies in Education: Examples

Barth (85) dipped back into early American history to describe the interplay between the pattern of Franciscan education (1502-1821) and the existing social institutions—the family, the church, the school, the economy, and the government. Dickerman (88) dealt with more recent

history, tracing the development of the summer school in American universities. Richey (112) dealt with the Civil War period in a way which adds to our basic knowledge; he made a painstaking statistical study. Flockstra (93), Ligon (106), and Williams (123) made historical studies based on legislation and court decisions. Three studies, by Good (96), Nietz (110), and Smith (119), dealt with textbooks. Two sociologists, Bernard and Bernard (86), traced the origins of American sociology; and the American Psychiatric Association (84) issued a review of one hundred years of psychiatry in the United States.

Educational History—Reviews of Recent Periods

Three magazines celebrated anniversaries during the past triennium. The *Journal of Educational Research* in January 1945 (Volume 38, p. 321-400) recognized the end of its twenty-fifth year of publication by articles which reviewed its own history and that of various phases of American education over the same period. Historical notes on the *Journal* itself were prepared by Ashbaugh, Charters, and Woody. Reviews of educational developments were written on elementary education by Brueckner (87), on secondary education by Douglass (89), on educational measurements by Monroe (109), and on administrative research by Scates (116).

The *American Journal of Sociology* recognized the end of its fiftieth year with the May 1945 issue (Volume 50, p. 421-563). The issue was devoted to articles which traced developments in sociology during the past fifty years, including research methodology (p. 474-82). [These reports may be compared with the review by Bernard and Bernard (86).]

The *Psychological Review* for January 1943 (Volume 50, p. 1-155) celebrated the semi-centenary of the American Psychological Association, as well as the centennial of the birth of William James (1842). Papers by Fernberger (92), Jastrow (99), Woodworth (124), and others outlined the history and progress of psychology and of the Association.

Other reviews of decades or quarter-centuries dealt with the progress of teacher education, by Evenden (91); child guidance, by Stevenson (120); and special education (100). Knight (105) wrote on a century of teacher education, and Quattlebaum (111) reviewed the educational activities during the war of federal emergency agencies. Eells (90) has continued his lists of centennial retrospects.

Legal Studies

Since it became the policy of the editorial board of the *REVIEW* in 1939 to treat educational legislation in connection with the area to which the laws applied, it reserved for the present section to deal only with general summaries of school law and historical studies based on legislation. The *Yearbook of School Law* is one of the war casualties since 1942. No general summary has taken its place. Many partial summaries have been prepared dealing with particular phases of education or with particular

states. Those who wish to review these are referred to the *Education Index*, topic: "Educational Laws and Legislation."

Quantitative Documentary Analyses

Systematic documentary studies may be made for a number of reasons, such as to trace chronological trends, to ascertain the character of books, or to gain knowledge about certain items contained in the publications.

Smith and others (119) traced the history of textbooks in arithmetic for the past 150 years, giving spatial analyses at different periods (p. 28). Shanas (117) reviewed articles in the *American Journal of Sociology* for the past fifty years, giving the percent of space devoted to different topics in each five-year period. These findings are interwoven with other factors to interpret changes in point of view and emphasis in sociology. Brueckner (87) analyzed issues of the *Journal of Educational Research* with respect to their contribution to elementary education at three dates. Fernberger (92) analyzed the number of papers on different subjects which were listed on programs of the American Psychological Association during fifty years. Gatlin (95) analyzed six educational periodicals from 1911-1940 to ascertain trends in the teaching of high-school grammar and composition.

Shannon and Kittle (118) analyzed eight textbooks in the field of research methodology for the purpose of comparing the proportion of space given to different subjects. They sought answers to such questions as, "What is being taught in courses in educational research? Where is the emphasis placed?" Fredenburgh (94) analyzed fourteen texts on guidance and rated them. Kinney (104) analyzed primary readers to see how well adapted they were to the ideas and experiences of rural children.

Kearney (102) ascertained the sentence lengths in 121 first-grade readers. Hughes (98) analyzed the topics dealt with in articles about education appearing in lay magazines. Kardatske (101) analyzed data concerning school superintendents listed in a biographical directory. Two studies of word usage will be mentioned, one by Rinsland (113), and one by Thorndike and Lorge (122); a full review of these should appear in the next issue of the REVIEW devoted to the Language Arts.

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CHAPTER II

The Case Study as a Research Method

PERCIVAL M. SYMONDS

SINCE the reviews by Olson in the December 1939, and by Strang in the December 1942, issues of the *REVIEW OF EDUCATIONAL RESEARCH* of the use of the case study in research methodology, progress has been made in this field. First, the case study has been of increased value to students of research in education, psychology, sociology, and anthropology; second, progress has been made in the technics of gathering and treating case study data for research purposes; and third, case material has been employed in many significant investigations.

The Acknowledged Value of the Case Study as Research Method

Whereas a few years ago the case study was often looked upon with suspicion as a method of research and whereas methods of gathering data by group processes that better lent themselves to statistical handling were favored more, the literature of the last three years has stressed the use of case material at least as a complementary and sometimes as a superior research methodology. Thus Hill and Ackiss (29) called the case method "a basically sound approach" to sociological research and held that "this methodology, moreover, bridges the gap between the stereotyped, factual community survey, and the personality-culture community study." Miles (44) referred to it as "one of the most important research methods of sociology." Cantor (11) and Lonsdale (40: 647) pointed out its value in social work research with the latter reporting that one private social agency, recognizing its worth, has engaged John Dollard to prepare "a design for research in case-record material." Riemer (45: 194) wrote that in criminological research to get at the units of causation "we shall have to direct our attention more eagerly to the study of the individual case." Young (60) while recognizing that "without quantification there can be no science" asserted that "with adequate concepts, careful observation of well-drawn small samples and the use of logical analysis some very substantial generalizations may be derived." Angell (2: 214-215) stated that in orthopsychiatric research "for real scientific work . . . a great deal of what has gone under the name of case study is prerequisite," but he adds the following significant comment: "The grave danger in working exhaustively with a few cases in order to obtain good analytical 'hunches' is that the investigator will become so involved in analytical speculation that he will never frame definite hypotheses, or that if he does reach this stage he will never subject them to the empirical test. Just as many statis-

ticians are inclined to leave the matter with an inconclusive correlation coefficient so the student of cases often fails to carry through to the verification of his hypothesis." In family life research Rockwood (47: 647) found that the once utilized historical, descriptive, and typological approaches "have been almost entirely replaced by the sociometric and case study approaches." Adequate genetic research, Good (27) held, also should make use of case methods.

Sarbin (50: 600) who compared the prediction of college achievement by clinical counselors using case study methods and by regression equations derived from nonclinical data reached the conclusion that actuarial predictions are more important than predictions based on case study material. He stated "the clinical predictions add nothing to the actuarial prediction." In a later paper Sarbin (51: 214) concluded that "the operations of those who reject the statistical method of prediction and substitute for it a 'dynamic' clinical or individual prediction may be described in one of two ways: Either they are making statistical prediction in an informal, subjective, and uncontrolled way, or else they are performing purely verbal manipulations which are unverifiable and akin to magic."

Sarbin's experiment seems conclusive within the circumscribed field in which he operated but inasmuch as case study methods vary according to the methods, skill, and judgment of the worker, this experiment by no means settles the issue. Sarbin has been challenged by Chein (16) who accused him of possessing a narrow conception of the clinical approach. Chein pointed out the fact that the clinician is not primarily interested in prediction but in effecting change. He would contrast statistical prediction with experimental control and believes that the cause and effect relationships that are shown as one alters the situation and notes the changes produced have more significance than the static relationships which are shown by statistical correlation.

Not only has the case study method been extolled but other writers have been critical of the statistical as opposed to the case study approach to personality research. Thus Frank (2: 246) deemed it "highly questionable whether the mathematical and statistical operations we use are valid instruments for biological and social data." Bloch (7: 504) held that much of the research which uses multiple correlation actually "leaves us with very little more at the end than we had when we started." Bowman (8: 308) stated that "sociological data seldom yield to quantitative expression at the present stage of development." White (54) held that "the fundamental problems of sociology, as of ethnology and social anthropology, are essentially and intrinsically nonmathematical problems." Witmer (59: 2) pointed out that statistical methods and mathematical calculations, tho often identified with research, "are but tools to inquiry, at times appropriate to the problem at hand and at times not at all pertinent." And Maslow (43: 558) accused traditional mathematics and logic of being "handmaidens in the service of an atomistic, mechanical view of the world" and of therefore being inappropriate in

their present form to a holistic-analytic understanding of human personality.

Obviously, then, case study research methodology, while still under attack has had stout support from many authorities during the past three years.

Recent Innovations in the Gathering and Treatment of Case Study Research Data

During the three-year period there have been three major trends of development in the gathering and treatment of case study data for purposes of research. First: there has been an attempt to objectify both the collection and the analysis of case material so that subjectivity of interviewing and interpretation will be minimized; second: some definite progress has been made in devising new technics of analyzing, categorizing, and quantifying relatively amorphous case data; third: there has been a steady rise in the application of involved statistical procedures, including factorial and variance analysis, to case study material.

As regards the objectifying of case interviewing, Covner (18, 19, 20, 21) and Rogers (48, 49) have been particularly instrumental in developing technics of recording interviews phonographically in order to make them more usable for research and teaching purposes. Covner (18: 112) found that normally more than 70 percent of actual interview material was omitted from case reports and stated that "research possibilities seem almost limitless" for the recorded interview technic. Rogers (49: 433) reported that the material gained from recorded interviews "is priceless raw material for research." Rogers (48) has also pointed out that in nondirective interviewing valuable research data are gathered. He points out that the counselor has done nothing to bias the material, and there are no evaluations which arouse defense or shut off expression so that the material gained is a "chemically pure" expression of the client's attitudes. He believed that nondirective interviewing also leads to improved reliability of the report. Child (17: 318) advocated that case study data be used "for the construction of quantitative scales, comparable to those commonly derived from tests and questionnaires." Child (17: 309) also pointed out that analyses of case material could be made more objective by having the cases "independently evaluated by several competent judges."

There has been some discussion of methods of categorizing and quantifying uncrystallized case study data. Ackerson (1: 41-42) discussed such issues as (a) the prejudicial attitudes or beliefs on the part of the informant or examining staff; (b) the varying completeness of the case material; and (c) inadequate defining or grouping of terms by the indexers. He discussed certain statistical tests which might be employed in deciding whether to keep separate or to merge apparently similar and overlapping rubrics. Creegan (22) discussed categories to be used in

the analysis of personal documents such as diaries, letters, or autobiographies. Andrews and Muhlan (3: 108-109) set forth a method of analyzing "congruent idea patterns" in the study of personal documents. By analyzing data into categories and graphing the frequency with which each of these occurred in conjunction with each other category, it was possible to find those that showed the same pattern of frequency. Dory (23: 285) reported the development of an index of 1275 titles of the headings used in psychiatric classifications to be used in the classification of psychiatric case records.

Along this line, work has been done in an attempt to determine the fundamental structure of personality; and the results of this work may become of service in the classification of case study material. Marzolf (42) discussed the statistics of syndrome formation in terms of the correlation and grouping of the symptoms which go to make up a given syndrome. He discussed the various types of factor analysis which might be employed in determining the structure and causative background of a given syndrome. Marzolf expected that insight would be thrown on the nature of a syndrome by determining the matrix of correlations between the symptoms of which a syndrome is made up and the antecedent conditions which precede them. He pointed out that diagnosis, statistically, is the reverse of prediction and that the clinical worker is as interested in knowing what factors have cooperated to produce a certain result as he is to know what result will follow from a given combination of factors. Cattell (12: 581-583) advocated factor analysis to "detect and delimit common dynamic unities" in personality traits with special recommendation for the employment of what he called the methods of temporal covariation and temporal invariance in determining trait unities. Maslow (43: 546), tho pointing out the necessity for caution regarding the data correlated and the tempering "of all statistical with clinical and experimental knowledge," stated that "there is no reason why correlation technique should not be highly useful in a holistic methodology." And Ackerson (1: 14), in a sizeable volume, demonstrated how the presentation of case study data on thousands of subjects could be presented "almost entirely by the comparison of correlation coefficients."

Finally, what might be called the very heart of case study research methodology, the formulation of integrated (holistic, total, organismic, dynamic) concepts of human behavior from the analysis of case material, advanced in the period under consideration. Thus, Riemer (45: 201) showed how, from close scrutiny of case studies, "ideal types" could be ferreted out whose predictive values could then be statistically tested, within certain logical limits. Witmer (59: 10) reported how categorization and quantification of case records may be done so that relationships are shown in tabular form "while at the same time the individuality of the cases is to some extent preserved." Bellak and Jacques (5: 38) pointed out that case studies can be seen properly only when the three main levels of personality, the biological, psychological, and sociological, are

adequately *integrated* "without unduly emphasizing the importance of this or that set of facts." And Child (17: 318), while endorsing the employment of quantitative technics, held that "the investigator's total evaluation of the individual subject" was most important because "the scientific utilization of the investigator's total impressions of the individual may be a prerequisite to the eventual erection and measurement of the most significant variables."

In several major respects, therefore, substantial recent progress has been made in the development of case study collection and treatment for research purposes.

The Employment of Case Study Technics in Significant Researches

In the actual use of case study material for research purposes, there have been two notable trends during the past three years. First of all, several comprehensive single case studies have been reported in the literature in an effort to give insights into the kinds of personalities who were their subjects and to aid in the development of the technic of presenting longitudinal case histories. Thus, White (55, 56, 57) has reported extensively on the personality of "Joseph Kidd." White, Tompkins, and Alper (58) have presented a "realistic synthesis" of one subject, including a complete case history and records of many personality tests. Burlingame and Freud (10) have given several reports on the development of the child "Tony." Lindner (39) has devoted an entire volume to the hypnoanalysis of one criminal psychopath. Jones (36) has presented a book-length longitudinal study of a normal adolescent boy. Robinson (46) has given us two rather complete case records showing the personality changes that take place in the course of the social case work process. And Laton (38) has summarized the life history of "Penelope Pride," a normal woman of the nineteenth century West.

The second important trend in the utilization of actual case studies for research purposes has been the publication of many articles and books reporting projects and experiments primarily or entirely based on case material. Thus Biber and others (6) made an intensive study of ten seven-year-old children who had been students at the Little Red Schoolhouse in New York City. From this intensive study of individual children, she was able to point out certain characteristics of this age level. DuBois (24) reported an anthropological study of inhabitants of Alor Island in the East Indies by making intensive case studies of a few individuals in a community in which she lived. She was able to draw conclusions as to the character of the Alorrese culture. Jenkins (35) reviewed the cases of many Negro children of Binet IQ 160 and above. Beecher (4) analyzed twelve case histories of behavior problem pupils. Martin (41) examined 3000 case studies in order to determine parental attitudes and their influence upon the personality development of children. Symonds (52)

studied the needs of fifty teachers as shown in their autobiographical histories. Ellis (25) employed eighty-four medical case studies in an investigation of the psychology of human hermaphrodites. Hurewitz (34) went over twenty-five cases to discover some criteria for judging applicants' ability to utilize family agencies' services. Hollis (31) analyzed several cases to try to determine the effects of the war on marriage relationships. Landis and Bolles (37) studied one hundred physically handicapped women to explore their personality and sexuality. Hirt (30) quoted ten case histories of superior children in her study of IQ changes. Ackerson (1) also brought out the second volume of his study of children's behavior problems, which he based upon case studies of 2113 boys and 1181 girls. And in the field of medicine, particularly its psychosomatic aspects, important studies too numerous to mention here were published mainly or wholly backed by case study reports.

Summary

The past three years have been important ones in the development of the case study as a method of research. During that time, the case study has been highly valued in many fields of research, has been refined and augmented along several consequential lines, and has been utilized in many notable research studies. However, much remains to be done to improve its methodology so that case materials may be amassed and treated in a manner that includes, on the one hand, objective appraisal and statistical integrity and that, on the other hand, never loses sight of the integrated, dynamic, holistic picture of human personality which the case study approach to research uniquely may give.

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CHAPTER III

Trend, Survey, and Evaluation Studies

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THIS chapter continues the reviews of evaluative studies and of survey and trend studies for the period July 1942 to June 1945. The concept of evaluation is being extended and adapted not only within the area of appraisal but also in survey, trend, and large-scale testing programs. While questionnaire studies still predominate, there is an increasing trend to the use of other methods of obtaining observational evidence. Further, there is a tendency to use the results of previous surveys, records, and observations in conjunction with follow-up studies to point up trends in education.

Critical Background for Evaluation

Many so-called evaluation studies are defective in one way or another. Certainly the defects that Davis (35) found as limiting the applications of psychological research to schoolroom learning are relevant. He found these defects to be: (a) lack of adequate preplanning; (b) failure to determine and report validity and reliability of instruments; (c) inadequate time duration of studies; (d) faulty sampling; (e) generalizations unwarranted by the observations; (f) lack of confirmation of previous studies; (g) lack of standardization of research procedures. Such inadequacies and others are the basis of Scheinfeld's criticism and reappraisal of Goddard's *Kallikaks* (138).

The appraisal controversy between evaluation and measurement continues. Scates (137) contrasted the differential objectives of scientist and teacher in measurement asserting that there was a fundamental limitation in purely scientific approaches to measurement of child growth. Sims (143), however, implied that the problem was the distinction between observation of phenomena and the values that such data have for education. Evaluation for Monroe (102) was the explicit measurement of all aspects of educational growth, thus requiring the defining, identification, and appraisal of all behavior related to educational objectives. Courtis (23) attempted to clarify the semantic confusion by quoting Thorndike's definition "a pupil's score in a test signifies just such and such particular achievement and second only whatever has been demonstrated by actual correlation to be implied in it." Courtis suggested that the fault was more often with the tester [or interpreter] than with the test or other observation. On this basis he (24) suggested ten steps in educational measurement including the sponsorship of maturation units. Barr (8) editorialized succinctly on the problem.

Cook (21), Cowell (25), and Smith (144) reviewed recent procedures in evaluation. Smith mentioned nine bases for evaluation of curriculums including mastery of basic skills, ways of thinking, understandings, and insights as revealed in social behavior, gains in knowledge thru attack on personal and social problems, interests as related to activities, personal initiative and creative power, sincerity and potency of attitudes, and post-school vocational competences. Cook discussed various purposes of evaluation and evaluates some of the technics. Tyler (159) indicated the relation of evaluation to functional supervision with a specification of the six basic assumptions, procedures, the use of evaluation in improving instruction, and the results of evaluation. Ragsdale (127) related rural community planning to curriculums in rural education.

Materials and Problems in Evaluation

The use of personal documents is surveyed critically by Allport (1) indicating their variety and values. In the manual prepared under the chairmanship of Guthe (59) was given an excellent review of methods of collecting data, experimental technics (59. Chapter V), and a bibliography of 682 titles on food habits.

The problems attendant to an evaluation program were discussed by Kirkendall (80) and Houle (69). The technic for beginning an evaluation program was related to the analysis of educational objectives (48). Sweetser (155) emphasized the relationship of neighborhood research to interpersonal interaction.

Lamson (85) demonstrated that college freshmen can be objective toward evidences of their intellectual ability and academic achievement. The third volume on the Eight-Year Study (145) gave a critical appraisal of the development and use of the evaluation instruments: aspects of thinking (interpretation of data, application of principles, logical reasoning, nature of proof); social sensitivity (application of social values, application of social facts, and generalizations to social problems, social attitudes, social and economic beliefs); aspects of appreciation; interests; personal and social adjustment; and record forms. Pace (122) reported on the construction of a *situations* test arising out of student suggestions for appraisal of teacher-training instruction. Ordan (118) surveyed the development of social concepts thru tests of vocabulary recognition, vocabulary classification and interpretation, and values of social concepts thru the *headlines* test in Grades IV thru IX in New York City public schools. The Santa Barbara Behavior Rating Scale (146) was developed and applied in conjunction with a revised curriculum.

A practical procedure for interpreting gains in test-retest scores for pupil scores was made (157). Bolton (12) rediscovered McCall's suggestion for evaluating teaching effectiveness thru achievement test scores. As is usual, there is no adequate consideration of the regression error.

Evaluation Studies

The report of Troyer and Pace (158), *Evaluation in Teacher Education*, has been an important contribution. It described and analyzed evaluation from the point of view of institution and individual in selection, orientation, guidance, follow-up, and growth in service with dozens of specific appraisals including a section on workshops. Hildreth (65) appraised the University of Utah Workshop. The important Minnesota studies in evaluation were extended by Williams' appraisal (173) of a representative sampling of a hundred students using interviews with their mothers, with both parents, check lists and questionnaires, interviews with students, data from health records, and tests to appraise the "consumers of general education"; and by Eckert's (46) follow-up of seven hundred former students to estimate their readiness for continued learning, orientation to personal problems, home and family living, vocational readiness, and socio-economic competence. Wrightstone (176) wrote a brief review of the evaluation of the New York City Activity School Experiment which used tests of basic skills, critical thinking, current affairs, attitudes, and personality, the *School Practices Questionnaire*, and the New York State Education Department *Scale for Rating Elementary Practices*.

Self appraisals have been utilized extensively. The Cooperative Test Service (28) has related college student opinion on adequacy of their training to scores on the cooperative tests. Ashbaugh (7) had freshmen and seniors rank educational objectives. Criteria for rating or ranking faculty by students were developed and used (6, 116), and under Dahm (31), a survey of college student opinion was made.

Using his "Criteria for Teaching and Learning Materials and Practices", Bruner (16) had 945 teachers and administrators evaluate their own ideals and practices finding a wide gap between ideals and practice. Antell (5) reported on teacher opinion of the value of different supervisory practices; Jensen (75) had students appraise eighty-three courses in teacher-training institutions on a nine-point scale; and Corey and Froehlich (22) reported a study of pupil's acceptance of responsibility.

Evaluation of Methods—Experimental

Seven studies were made of the consequences of membership in 4-H projects as contrasted with nonparticipation. Frutchey and his co-workers (49, 50, 51, 52, 53, 54, 55) appraised educational growth in terms of objectives of information, self-confidence, attitudes, experiences, habits, school plans, and vocational plans. The duration of the studies was usually five months altho in the dairy project it was eleven months. The method involved the evaluation of gains from pretest to posttest comparing participants with nonparticipants and also contrasting participants who completed their projects with those who did not. In some of the reports, the members evaluated sources of help and specific printed materials in terms of helpfulness.

Peters (123), using his regression technic for equating pupils, studied the results of democratized education in terms of factual knowledge, civic beliefs, school practices, and achievement. Using tests of abstracting and organization of information and of drawing conclusions, Anderson, Marcham, and Dunn (2) reported the results of doing versus telling on critical thinking. Weiden (170) using a three-group procedure evaluated the effects of giving marks, giving marks with correct answers indicated, and giving marks, correct answers and remedial instruction in algebra. Curtis (30) used a rotational paired group procedure to evaluate excursions. In a five-term study, Ryder (135) appraised the effects of student teachers on pupils in terms of achievement, attitudes, and appraisal of teachers. The method was matched pupils for regular and student teachers.

Johnson (76) surveyed the results of changed curriculums in arithmetic on pupil achievement, and Overn (120) appraised the effects of the specific teaching of patriotism. Jayne (74) in a rotated group experiment evaluated the immediate and retention effects of lecture versus silent film presentation. Morgan and Steinman (105) evaluated a testing program in teaching of educational psychology. Hamalainen (60) made a critical appraisal of the results of teachers' anecdotal recordings in terms of the relationship of the teachers' appraisal of pupils versus objective test information. His study would have been more valuable if extended another year or two.

Pintner and Gates (124) directed the study on the value of hearing aids for auditory handicapped pupils. The experiment showed no statistically significant difference for matched pupils wearing aids and those not wearing them in Stanford achievement, aspects of personality, pupil portraits, or speech. Duell and Kenet (40) found that pupils attending summer high schools gain more than regular pupils. Goldstock (57) in a five-year study of remedial readers gave a statistical summary of the results.

Testing Programs

A continuation of the Orleans and Saxe studies of arithmetical knowledge was made. This time (119) two thousand New York City high-school pupils took a test of arithmetic reasoning. The evaluation was made in terms of variation, details of knowledge, difficulties, errors, frequency of errors, and probable cause. Eaton (42) reported the results of the Stanford Intermediate Arithmetic Test. No marked difference in the achievement of pupils as related to the time devoted to arithmetic study was one of his conclusions. He (43) arrived at the same conclusion in the survey of social studies using the Stanford Intermediate Social Studies Test. Are Rice's conclusions, developed in the 90's, being reconfirmed?

Davis (33) analyzed the results of the Kentucky Scholastic Ability, Kentucky English, Kentucky Mathematics tests, rating scales for social ideals and emotional drive for a stratified sampling of 1940 high-school graduates as related to college or noncollege attendance. The factor of

college attendance was studied in relation to quarters of the distributions of the test scores, to place of residence, size of family, income, socioeconomic status, and family income.

The sophomore and freshmen testing program in Michigan high schools (175) reported on mental capacity of pupils, interpretation of social data, interests, adjustments, and behavior patterns. Dalton (32) made a visual survey of elementary- and high-school pupils using the Keystone Telebinocular.

Trend Studies

Several important demographic studies of immediate interest to the educator have been published. Beers and Williams (10) studied the age structure of Kentucky's population from 1860 to 1940 for the state, for rural and urban regions, by counties and by subregions. Oyler (121) for the same state, reported trends in fertility and migration in relation to various factors (for education, he used the ratio of high-school attendance to elementary-school enrolments). Glick (56) reported on family trends from 1890 to 1940; Crane (26) indicated industrial and occupational trends in New York State from 1910 to 1940.

Based on a questionnaire, the National Education Association (110) has continued its study of salaries of city-school employes including trends from 1930-31 to 1942-43, and 1944-45 (111).

A significant use of high-school reports was made by Landis (87, 88, 90, 91) in appraising the posthigh-school activities of Washington State graduates. Landis pointed out that the data are limited by the reliability of the principal's reports, the categories of activities, and the fact that about a quarter of the graduates' activities are unknown.

Two trend studies appraised the effects on schools in the war period; one on 1426 school systems (112) and the other on teachers colleges (113). A series of reports (3) showed the progress of adult education in the war period.

The progress of adult education can be compared with the trend in public-school adult education in the cities from 1929 to 1939 (62). Curriculum trends for a ten-year period in Iowa (104), trends in consumer education (61) from 1938 to 1944, trends in high-school supervisory practice from 1936 to 1942 (101), and trends in guidance practices (29) in public secondary schools and public agencies in New Jersey from 1932 to 1935-36 to 1940-41 were primarily based on questionnaire studies. The status of New York State elementary-school principals was given for 1927 and 1941 (172).

Reinsehl (131) made a statistical study of trends in time allotments for school subjects and in length of school days. Rhodes (133) reported on supply-demand data based on questionnaire responses of graduates of a teachers college. Law (94) listed nine significant trends in teacher education. Morrison (109) showed the increase in research activities of

thirty-two state departments of education, and Rockwood (134) suggested a trend to the use of sociometric and case study approaches in place of the historical, descriptive, and typological procedures.

Attitude Studies

A number of studies show trends in changes in attitudes. Despert (37), using questionnaire responses of parents after a meeting with them, made a special study of children's reactions to the war comparing seventy-two nursery-school children who attended the Payne-Whitney school from 1932 to 1937 with sixty-three who attended the school from 1937 to 1942. College students' changes to war were studied (39, 78, 177) with Dudycha (39) implying that scales of the Thurstone type are unsatisfactory and Hunter (70) reporting on attitude changes of college women over four years.

Follow-up Studies

The significant Brush Foundation Study of Child Growth contributed information on the stability of psychometric results from age three months to ten years (44) using both genetic and cross-sectional data. The correlation of intelligence tests at age three years to age ten years in successive half years decreased from .75 to .60. Another Brush study (142) reported on serial examination of an identical group of 999 children from age three months to eighteen years in physical growth and development. Lorge (97) studied the test-retest results of 131 persons in intelligence over a twenty-year period in relation to the number of years of schooling obtained. The test-retest correlation was .60, but when years of schooling was added the correlation increased to .80.

Traxler and Selover (156) gave evidence of the decrement of prediction of secondary-school achievement from elementary-school achievement over time, but noted that prediction in linguistic areas was superior to prediction in mathematics.

A follow-up study of Wickman's 1927 evaluation of behavior problems (4) indicated that mental hygienists and teachers are closer together in thinking in 1940. For the most part, this is attributed to a growing conservatism of mental hygienists.

Boyce and Bryan (13), by questionnaire, attempted to find out if persons in later years rate their teachers as they did while in their classes. Unfortunately, the study is not properly a follow-up since the subjects were asked for retrospective memory with the stated objective to find out if pupil's judgment changes. Additional follow-up studies were made of school graduates' appraisal of school objectives (98), of the high-school program (77), of private school graduates (64), of occupational activities of high-school graduates from 1892 to 1939 (63), and of rural eighth-grade graduates (19).

The Office of Education has made a follow-up survey, by direct interview and questionnaire, of supplementary trainees for war production (162) and of preemployment trainees, including evaluation of their instruction in vocational courses (161). Webster (169) appraised the value of vocational guidance given two to five years previously.

An analysis of attendance records in relation to test-intelligence and academic records was made for the college class of 1935 (152); an appraisal of the educational careers of nonreaders was made over eight years (93). The leisure interests of students were studied for the period 1900 to 1930 (86) and for college women over ten years (164). Morrison (108) studied the holding power of New York State's rural secondary schools and their postschool activities.

An important follow-up appraisal of the evaluative criteria for secondary school was reported in a bulletin of the National Association of Secondary School Principals (163).

Surveys

A number of surveys of specific areas were made; for instance, a survey of the content of general science courses in forty-eight states and 655 junior and senior high schools (71, 72); of language teaching in Wisconsin's public high schools, covering enrolment, patterns of offerings, teaching load, tenure, preparation of teachers, and teacher appraisal of objectives (81); of the objectives and organization of elementary-school art programs in sixteen cities (95); of planning for education in Kentucky (139: particularly Chapter 6); of opportunities for community study in colleges (117); of evaluational technics for in-service appraisal of teachers (165, 166, 167, 168); of religious instruction in Negro colleges (107); of facilities and practices in fifty-eight psychological clinics for the diagnosis and therapy of poor reading (84); of the status of rural education in the South (36); of the policies and practices of adult education in twenty-one representative cities in California (27); of the school organization of seventeen four-year and thirty-four three-year junior high schools (82); of the use of radio in 2348 rural and urban schools (130); of consumer education courses in secondary schools and junior colleges (15); of the teaching of sex education in California including extent, nature, personnel, and methods (73); of juvenile delinquency, around the idea of racial segregation and social disorganization, in twenty cities (140); and of the frequency of occurrence of items in cumulative records in the United States (160: Chapter 1).

Acceleration under the pressure of war was surveyed in thirty-nine representative institutions in relation to admissions, enrolment, faculty, and finances (99). Eckelberry (45) reported on the extent of educational acceleration in 448 colleges and universities, and Pressey (125) gave a first report on the experiences with the accelerated programs in a large university. Brandon (14), by questionnaires to college presidents, surveyed opinion regarding postwar developments in education.

School surveys have not been published to the extent noted in previous years. Reller (132) described types of school surveys and suggested their relative values. Surveys were made for Newark, N. J. (153), for Tenaflly, N. J. (38), and for Boston, Mass (154). A significant survey of the opportunities for improving high-school education in Virginia was made under the sponsorship of the Virginia Chamber of Commerce (92). The high-school seniors were tested with the Cooperative American History, the Cooperative English, the Schorling-Clark-Potter Arithmetic tests.

An analysis of drop-outs and causes, of reactions of employers, of school facilities, and teaching procedures is given in an appendix of thirty-four tables. The San Francisco elementary curriculum survey (11) was basically a cooperative attempt to evaluate the curriculum. Studies were made of time allotments; texts; and supplementary materials, curriculum trends over thirty years; attainment of pupils in arithmetic, spelling, handwriting, critical thinking, and general information. In the survey there was developed a general guide in classroom observations (11: Appendix A). Carter (11: Appendix C) studied age-grade distribution in 1929 and 1939, and Kyte (11: Appendix D) analyzed a checklist of supervisory needs of teachers.

The National Education Association (114) surveyed opinions on compulsory military training. Holland and Hill (66) made a critical survey of the CCC as a youth-serving agency, and Davis and Taylor (34) evaluated the high-school N. Y. A. program in Colorado. The place of work experience in schools was appraised thru a survey of opinions of students, parents, employers, and educators by McDaniel (99).

Using demographic data, Brunner (17) contrasted the educational status in the geographic regions of the United States and also by rural-urban comparisons. Moigan (106) summarized enrolment trends in California schools during 1942 and 1943; Holy and Wenger estimated adult interest in public schools thru their own children (68); Punke (126) surveyed the socio-economic backgrounds of high-school youths; and Landis (89) studied territorial and occupational mobility of Washington State youth. He had all eighth-grade children and all social science students in high school fill out a questionnaire for every older sibling who had completed schooling. Landis (89) measured territorial mobility as the difference between place of schooling and first and present job, and occupational mobility as the difference between occupation of fathers and first and present job.

Eaton (41) studied Indiana University withdrawals by inquiry as to reason at registrar, high-school principal, and officials at chapter houses. Mooney (103) studied personal problems of freshman women; Young (178) surveyed the interests and preferences of primary children for movies, comics, and radio, using interviews and analyzing by intelligence, age, and economic levels. Feingold (47) made a study of newspaper interests and habits of high-school students; Gress (58) tried to evaluate the educational needs of potential inductees thru a questionnaire of

men in the armed service; Holtorf (67) surveyed recreational activities in seven Detroit elementary schools.

Salley (136) completed a survey and analysis of graduates of teacher-training schools and of organizations sponsoring preschool groups in New York City relating factors of supply and demand. Kaplan (79) structuring the city of Springfield into ecological areas made a study of factors related to adult participation in cultural and educational activities.

Burt (18) used the poll technic to get British schoolmen's opinion to educational reforms; Reavis and Cooper (128) made a critical survey of merit rating of teachers; and the National Education Association (114) contrasted teachers' salaries with those of other groups.

Appraisal of Materials

Bathurst (9) reported the results of a questionnaire appraisal of phonograph recordings; Wiebe (171) indicated the value of the "program analyzer" for radio broadcasts; Woelfel and Robbins (174) evaluated the use of radio in the classroom; and Reid (129) gave the results of a critical appraisal of twenty-six school broadcasts of the Columbia Broadcasting System by teachers using "How to Judge a School Broadcast" and by the Ohio staff collective appraisal of the program's educational values, understandability, and enjoyment. Kopel (83) described the development and use of twenty-five criteria for evaluating reading texts and programs.

Frequency Studies

The *French Syntax List* (20) based on a frequency study of grammatical usage in contemporary French prose has appeared. It is based on credits for range and frequency. Lindgren (96) studied the frequency of occurrence of foreign words in newspaper English and reported an increase from 1930 to 1940. A frequency count of the mention of personages without explanation or modification made it possible for Shaw (141) to suggest the five hundred leading personages, at least in the *Readers Digest*. He does not give the complete list.

Smith and his co-workers (147, 148, 149, 150, 151) made a content analysis of arithmetic textbooks for five periods: 1790 to 1820, 1821-1850, 1851-1880, 1881-1910, and 1911-1940, relating these analyses to make-up, method, psychology, pedagogy, and the social and economic life of each of the periods. The summary (151) indicates trends in arithmetic texts.

Conclusion

The variety of material covered in this review was extensive. Basically, most of the material was good. Surveys, particularly school surveys, continue to make recommendations that seem to be unrelated to evidence; questionnaire results still are published even when based on less than a quarter of those canvassed; trend studies fail to look into the variations

in definition and terminology in successive periods. On the other hand, many of the studies are analyzed more critically and with proper awareness of the limitations of the observational data or of the subsequent analyses.

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CHAPTER IV

Research Methods and Designs

CHARLES C. PETERS, AGATHA TOWNSEND, and ARTHUR E. TRAXLER

THE EXPERIMENTAL studies in education during the past three years may be divided into three broad groups: (a) studies in which the data were presented without indication of the statistical significance of the results; (b) studies using conventional procedures such as the difference between the mean scores of matched experimental and control groups divided by the standard error of the difference; and (c) studies employing newer procedures in which the Fisher technics were applied. Apparently, there is approximately equal representation of studies using the earlier methods and those using the Fisher approach.

As one would expect, studies appearing in certain journals, *e. g.*, *School and Society*, the *School Review*, and the *Elementary School Journal*, tend to be simpler in design and much less complicated statistically than those published in other journals, *e. g.*, the *Journal of Educational Psychology*, *Educational and Psychological Measurement*, and the *Journal of Experimental Psychology*. The readers of the first group of journals tend to be classroom teachers and administrators who are not highly conversant with advanced statistical technics, particularly the newer ones. Some research studies having important practical applications are necessarily presented on an elementary plane; otherwise they would be neglected by the very persons for whom their results are potentially the most helpful.

Certain studies whose design is not planned with great attention to detail and for which the significance of the results is not given in statistical terms may nevertheless appeal to their readers as important and significant from the common-sense viewpoint. For example, Riefling (64) reported the gains of pupils in Grades IX and X on the Iowa Silent Reading Test and the Morrison-McCall Spelling Scale after certain instructional procedures were used with the two classes. The gains for *four months* in terms of the gain in the grade equivalents were: average gain in spelling, 1.3 grades; and average gain in reading, 1.4 grades. The implicit control group was the norming population reported by the test authors. Altho nothing was said about the statistical significance of the gains, it is probable that most teachers would agree that the results of an experiment showing gains of about one-and-a-third grade levels in four months are important regardless of tests of statistical significance.

In another study whose design was simply that of the regular school situation and whose results were interpreted on a reasonable basis, Kottmeyer (41) described an in-service program of improvement in reading begun in November 1943, and continued during the rest of that school year. The study reported the mean scores made on a reading test by the

eighth-grade graduating class of June 1944, and compared the means with those found for the graduating class in June 1943, before the in-service program was begun. The difference in the gains was six-tenths of a grade in favor of the class which had taken part in the program of improvement in reading. No test of statistical significance was applied; but since about four thousand pupils were involved in each testing, the difference in means seemed to indicate clearly the worth of the reading program.

Other studies in which the results were stated and interpreted in the common-sense, everyday language of teachers were carried on by Folger (23), Guiler and Edwards (25), Guiler and Lease (26), Krause (42), Tate (75), and Witty (86).

Classical Procedures and Minor Modifications of Them

In this REVIEW there is only brief discussion of studies employing standard "classical" procedures, *e. g.*, difference between means or difference between proportions divided by the standard error of the difference (unfortunately named critical ratio), and simple and partial regression. In view of the fact that these methods are well known, more extensive treatment of the so-called newer methods is made. In no sense does this selectivity imply disparagement of the studies involving the so-called classical procedures. Among the studies done well by these standard methods were those by Corey and Froehlich (12), DiMichael (16), Johnson and King (33), Landry (44), Remmers (63), Traxler (79), and Woodward (88). Among them was also the significant "Eight-Year Study" (6) sponsored by the Progressive Education Association.

In the majority of the studies employing classical procedures, the authors had given the essential data needed by the readers. In a few cases, too few data were included in the article. For instance, Ludden (46), in an interesting study of juvenile delinquency, gave the critical ratios of differences between a delinquent group and a control group but did not include means or standard deviations. Thus, one reading the article could not check the statements concerning significance, nor even know the intrinsic magnitude of the differences.

Occasionally, studies using a conventional experimental technic fail to control other variables which may influence the results. A study by Jones (35) of the much debated relationship between reading deficiencies and left-handedness illustrated this point. She compared the mean Iowa Silent Reading Test scores of 569 right-handed children and fifty-seven left-handed children. A very slight difference in favor of the left-handed children was found. The "critical ratio" was 1.4. She correctly concluded that her data showed no significant difference between clearly left-handed and clearly right-handed children and inferred that no specialized remedial reading technics were necessary in handling left-handed children. The study is of value on this point, but it would have been more conclusive if intelligence had been controlled; for it is known that there is a rather

close relationship between intelligence test scores and Iowa reading scores. The group of right-handed children was large, and it is reasonable to expect that it was representative of the intelligence level of the school from which this sample was drawn; but, since the group of left-handed children contained only fifty-seven cases, there is no assurance that they represent a fair sampling of left-handed children in that particular community.

Author misinterpretation of data obtained by conventional procedures seems to be rare. One such error was noted in a study by Peterson (60) of the scholarship of students housed in various living quarters. He compared the mean grade-point averages of students living in dormitories, rooming houses, cooperatives, fraternities, and at home. He reported the difference in means, the probable error of the difference, the difference divided by the probable error, and the chances in one hundred that the results represented a true difference. In considering dormitory versus fraternity house, he found that there were one hundred chances in one hundred that the true difference of means was greater than zero. He interpreted this difference as follows: "Other things being equal, the average student in a dormitory at Davis always will do better scholastically than if he lived in a fraternity." One cannot, of course, draw such a conclusion concerning the behavior of any individual student. All he can conclude is that if an infinite number of similar samples were drawn from the dormitory and the fraternity-house students at Davis, the chances are certain, or practically so, that the grand mean grade point average of the dormitory group would be higher than the grand mean grade point average of the fraternity-house group.

Newer Technics

Certain journals which accept extensive articles, such as those written by candidates for the Ph.D. degree, contain many illustrations of the application of somewhat more technical, experimental, and statistical procedures. Among the more sophisticated studies in which the mathematical procedure was presented in considerable detail were articles in the *Journal of Experimental Education* by Baten and Hatcher (3), Clark (8), and Tsao (82). The last study dealt with the relationship between grade and age and variability and obtained results contrary to the widely accepted common-sense principle that variability increases with grade and age. His technics included Neyman-Pearson's L_1 test and Bartlett's test of homogeneity. He also discussed Snedecor's methods dealing with analysis of variance for unequal subclass numbers and Hoyt's procedure for testing the variability affected by test materials. The question investigated by Tsao is of considerable theoretical importance and should be studied further.

One of the best illustrations of the application of Fisher's t test (a minor modification of the so-called critical ratio) to an extensive set

of results was given in a series of four articles by Rulon and others (66, 67). The authors compared phonographic recordings with printed material in terms of knowledge gained thru their use alone, in terms of knowledge gained thru their use in a teaching unit, and in terms of motivation to further study. They also investigated the effect of phonographic recordings upon attitude.

Occasionally a new experimental technic is superior to a conventional one in getting all possible significance out of the data. In a study of the effect of type of desk on results of machine scored tests, Traxler and Hilkert (80) compared the mean scores made on the machine-scoring form of the American Council Psychological Examination in Grades IX thru XII by two groups of pupils, one group taking the test at desks and the other group taking it in chairs with desk arms. Five pairs of groups were selected at random and two additional pairs were matched on the basis of Otis IQ. The significance of the difference in mean scores was interpreted in terms of the difference divided by the probable error of the difference. All differences were in favor of the desk group, but they were small; and only one was as much as four times its probable error. It was concluded that type of desk made slight difference in the results. Kelley (38) applied additional statistical technics to Traxler and Hilkert's data. He pointed out that a method was needed combining all of the data with due regard to the sign as well as the magnitude of each difference, and one that would profit by and investigate the regularity of change in difference from grade to grade. Using a regression method, Kelley found a ρ of .0016 at the ninth-grade level as compared with a ρ of .11 found from Traxler and Hilkert's data when they used cases at the ninth-grade level alone. Thus, according to Kelley's method, the difference at the ninth-grade level was clearly significant, whereas the significance of the difference was not apparent when the more usual experimental procedure was employed. The difference at the twelfth-grade level was slight and could not be established on the available data, but Kelley thought that there was some evidence that the regression was curvilinear and that the desk group continued to have an advantage at the upper-grade levels. In another article, Kelley (37) developed a test of variance ratios of components which was used by Davis (14) in connection with a factor analysis study of the Cooperative Reading Comprehension Test.

Analysis of Variance

Out of the several dozen studies using analysis of variance in some form we can select only a few typical ones for comment. McGurk (47) compared test scores of Negro children with those of white children by a three-part analysis. A 10 percent sample from more than 13,000 whites and 6000 Negroes, ages nine to seventeen, were compared by three different intelligence tests, with age partialled out. The classical method of partialling out the age factor would have been by matching the races according to age

group and using in the standard error of the difference formula the third term involving correlation between the intelligence test scores of the two groups thus paired. McGurk accomplished identically the same effect, according to the rules of a three-part analysis of variance, by taking out a sum of squares "between ages" and subtracting this from the two-part residual to get the purified estimate of error (59: 295). The eighteen F 's obtained by dividing the estimates of the population variance "between races" by this purified "error estimate" all showed highly reliable differences between the whites and the Negroes, reaching in every case beyond the .001 level of confidence. Since McGurk was intending to make six comparisons with each of the three intelligence tests, this procedure involved economy of time as compared with the traditional t test because by thus pooling the error estimate for the six comparisons a single estimate would serve for all. But he had to assume (as always in analysis of variance methods) that the true variance was the same in each of the age groups. Altho such an assumption may not be strictly true, it is not too extreme for a first approximation in situations where the reliability was sufficiently high.

Hartkemeier (29) studied the factors which affect teachers' salaries. In a correct and effective use of analysis of variance he compared the salaries of men and women in schools of different sizes, according to years in present position, and the extent of interaction of these factors. He found highly significant differences based on sex, size of school, and years in present position. He also made, with fair success, a commendable effort to explain to his readers the statistical technics he employed. Fischer (21) studied certain interests of college students by means of value-scores on the Allport-Vernon scale. By a two-part analysis of variance he found highly significant differences between the mean values scores on the six tests. Because the same persons marked all the sections of the test, the scores were probably intercorrelated. This possibility suggests the need for a three-part rather than the two-part analysis he made, so as to account for the probable interaction.

Musselman (53) investigated the factors associated with the achievement of high-school pupils of superior intelligence. He applied the F test to twenty-six tables of data. Then, if the F was significant, he reported an inspectional interpretation of the nature of the relation. In the case of some of these factors, as different nationalities, place of residence, or type of discipline used in the home, the F test was exactly the one needed because the classifications represented no quantitative ordering; the means of classes could be viewed only as varying at random. But in the case of others, as size of family, parents' education, socio-economic status, or scores on a personality inventory, the F test is not strictly appropriate because here there is quantitative ordering of the classes and the probability of deviation of the means of classes in a systematic manner. Particularly in view of the fact that each time he distributed the whole of the sample among the k classes with, consequently, unequal n 's, the correct way to

deal with material of this second category is curve fitting, and a test of the significance of the departure of the constants of the equation of the curve from zero—the correlation coefficient for a straight line fit and the newly devised parabolic correlation coefficient, or some more complex curve, for curvilinear regression. These more appropriate tests are more sensitive in showing statistical significance. Musselman's sample, however, was so large that he probably did not miss any important relation by using the cruder *F* test.

Newell (54) studied the relation between class size and extent of invention and diffusion of educational adaptations, using as sample nine classes in each of four wealthy New Jersey communities. She used a three-part analysis of variance effectively for this purpose. Then the author turned to the attempt to apply analysis of variance to the determination of the critical level of class size for adaptation, without very good results. A far better technic for this purpose, particularly if there is a reasonably large sample of schools, would have been to fit an appropriate curve to scores on adaptations on the *Y*-axis and class size on the *X*-axis, determine its equation by the method of least squares, equate the first derivative of this equation in respect to *X* to zero, and solve for the *X*-value that corresponds to maximum *Y*. A corresponding operation with the second derivative would have shown thru what class sizes the change in invention and diffusion was most rapid or least rapid.

Chang (7) studied the ability of Chinese children to read Chinese print when in the vertical as compared with the horizontal arrangement. He investigated the effect of arrangement, of different materials, and of grade levels as main effects, and also the first and second order interactions. He found the *F*'s exceedingly small for all of the interactions, ranging from .0007 to .91 in all of the sixteen instances. These he interprets as showing no statistically significant interactions, correctly as the term "interaction" is employed. If these *F* ratios had been inverted, the *F*'s would have been highly significant. That would have meant that the abilities to read the different arrangements by the same pupils were highly correlated, and likewise with the different types of materials—in some cases even nearly perfectly correlated (59: 292). But the interplay of the factors represented by high positive correlation is not the kind of interplay that is named interaction; such high, positive correlation means that the factors behave alike straight down the line, while "interaction" covers exactly the opposite kind of fact. When the *F* ratio is set up, as it is for testing interaction, with the interaction variance estimate in the numerator and an error estimate in the denominator, a fractional *F* means high correlation; and as the *F* moves up in value thru 1 to a sufficient size, the correlation between the factors decreases and even passes to negative. Thus high *F*'s mean low correlation, or a negative correlation, among the factors, and that therefore the factors behave differently in different combinations.

McNally (48) used the Latin square design to study the readability of certain type sizes and forms in sight-saving classes, using six sets of 6x6

Latin squares. He found highly significant differences among individuals and among randomly made test forms but entirely insignificant differences between type sizes, both in effect upon speed of reading and upon number of eye blinks. Since this finding was very surprising, the author tested the individual pairs of type size by the conventional *t*-ratio procedure. All but three of the sixty differences were quite insignificant and these did not seem reasonable or consistent, thus confirming the analysis of variance showing. The author correctly recognized that the equivalent of the taking out of the marginal sums of squares in the Latin square is, in the case of the comparison of the means of classes two by two, the three-term standard error formula which contains the correlation term. It would have been necessary to make the paired comparisons if the *F* had been significant, and the author is to be commended for anyway exploring the possibility "that some true differences were hidden in the data." For a nonsignificant *F* for a plurality of classes merely means that, on the average, the separate comparisons would not be significant and that the separate *t*'s have their distribution within the sampling distribution of a true *F* of 1.00. Snedecor advises that if, under these conditions, significant individual *t*'s are found that seem plausible, they should not be trusted from the present study but should be subjected to further follow-up experimentation.

Peterson (61) also used the Latin square, to investigate the effect of different combinations of reading and recitation upon immediate and delayed recall of long prose selections.

The character, virtues, and awkwardnesses of the "new" designs are typically illustrated in the Wisconsin study of *Radio in the Classroom* (83). This study found almost no statistically significant differences between the radio groups and the control groups. The analysis of variance and the chi-square technics are carried out and written up quite typically. The write-up is hard to read because one must hunt thru the book for the meaning of the abbreviations, tho the authors do help the reader by indicating at least the sign of the differences between means of the classes compared under the heading "value of the effect." Among other researchers employing analysis of variance are Knott and Tjossem (40), Selover (70), and Thompson and Hunnicutt (76).

The only case of correctly named analysis of variance encountered was by Hamilton (27); all the others were, as is the custom with this terminology, analyses of *sums of squares* and *comparison* of estimates of the population variance. Hamilton analyzed the total sample variance of achievement in three learning tasks thru various amounts of practice into the proportion due to individual differences ("within group") and that due to amount of practice ("between means" at successive levels). She was not interested in tests of significance but in the question of the percentage of the variance due to these two factors, and the study of whether this percentage allocation was constant or varied according to circumstances. She concluded that the latter was the case.

Covariance

The statistic "covariance" is defined as $\Sigma xy/N$, where x is a deviation from the mean of the X-variates and y is a deviation from the mean of the Y-variates. Obviously the covariance is the basis of our familiar regression equation, for b_{yx} equals $\Sigma xy/N\sigma^2_x$. Analysis of covariance is employed when end scores or end means are to be adjusted by means of the straight line regression equation for differences in some equating factor.

Three available procedures for thus adjusting scores or means for differences between groups on some initial criterion of learning ability, which come under the category of analysis of covariance, were employed in the period here under review. These methods all accept groups of unequal N's and/or of unequal mean abilities on the matching factors and make statistical adjustments for these differences, thus replacing the loss of subjects involved in the older matching method. The Fisher method of covariance was employed by a number of researchers, among them McNiel (49), Rostker (65), Stewart (72), and Willits (85), the Stewart write-up being particularly well done. This method is adapted to comparison of either two or more method groups and on either one or more equating variables, the simple regression equation being used in the case of one equating variable and the partial regression equation in the case of more than one. It employs for adjustment a regression equation made by combining experimental and control groups and is for that reason particularly well adapted to small samples because pooling the several groups yields a more stable regression equation than one alone would give. But it has as disadvantages (a) the fact that it must get the adjusted "between" variance estimate by subtracting sums of squares and must therefore make the F test rather than the more meaningful t test; and (b) it does not lend itself to diagnosis of the achievements as both of the other methods do.

The Peters' regression technic is best illustrated by the study by Van Voorhis (58, 84). Van Voorhis experimented with the possibility of improving a supposedly "primary mental ability"—space perception. He gave, to an experimental group of forty members in descriptive geometry, systematic training in visualizing space relations and compared their mean gain on the Thurstone test of this factor with that of a control group of forty-four members and also the means of grade points earned in descriptive geometry by the experimental and control groups. A partial regression equation for predicting end scores from a team of five matching factors was built up from the statistics of the control group; then the scores of the members of the experimental group on the five matching factors were employed in the regression equation to predict what end scores they should make if the experimental factor had no differential effect. He found that the experimental group exceeded "expectation" by a mean of 17.25 points on the Thurstone test and .65 in grade-point average in descriptive geometry. These differences yielded standard error ratios (by the Peters' formula) of 3.40 and 3.09 respectively, where the standard error ratio has

the same meaning as Student's t . So the differences between the "expected" means and the attained ones were highly significant statistically on both of the measured outcomes. This is exactly the same standard error ratio as would have been achieved if the groups could have been handled as perfectly matched groups in a matched group experiment. The Peters' technic differs from the Fisher analysis of covariance in making its regression equation from the statistics of the control group rather than from the experimental and control groups pooled, on the ground that a pooled estimate would be a meaningless hybrid if the two groups differed by reason of the experimental factor (as they almost certainly would in the total population); and it also differs by permitting an analysis of the differential achievement. Case studies can be made of those individuals who exceed or fall short of expectation, for these discrepancies are indicated for each subject; or statistical studies of these differential effects can be made by fitting simple or partial straight or curved line regression equations to the end-score deviations from expectation and the matching factors as co-ordinates. Or, if such analysis is not wanted, the individual predictions need not be made; the regression equation can be applied directly to the differences between experimental and control group means on the matching factors for the purpose of finding the adjustment for the end test means, just as in the Fisher method.

Instead of making separate steps of the adjustment of end results for differences in matching factors and the diagnosis of the differential outcomes, as the Peters' method does, the Johnson-Neyman's method combines into one process these two steps by determining "regions of significance". The Johnson-Neyman's technic is very ably used and clearly written up in a study by Deemer and Rulon (15), in which they compare the effectiveness of two shorthand systems. This method, when used with two matching factors, yields equations for curves from which graphs can be laid out on a plane surface bounding regions for the matching factors within which the differences between experimental and control groups on end scores are significant at the designated levels of confidence. If there is any law governing the kind of subjects for which one method rather than the other is significantly better (*e.g.* bright pupils with good socioeconomic background favor one method; dull ones with poor socioeconomic background favor the other), these graphs mark off the boundaries within which the one method or the other is significantly better. Individual pupils may be located on this plot and thus the potency of the method may be inferred for them. In the typical study the method is used with two matching factors only; with one matching factor the individuals would be located along a linear continuum, while with three or more they would need to be posited in a form in space of three or more dimensions—in some form of conicoid (ellipsoid, paraboloid, or hyperboloid).

Some of the additional researchers who used the Johnson-Neyman's technic are Clark (8), Hansen (28), Johnson (32), and Treacy (81).

Uses of Chi-square

As would be expected, a considerable number of studies employed chi-square, of which only a few can be reviewed. Daniel (13) had respondents declare interest in a list of one hundred items for a library by five categories, as follows: strongly yes; yes; indifferent; no; strongly no. Responses were set up for each item separately for males and females involving the five types of responses, thus making 2×5 contingency tables, and a chi-square was computed for each of the items on the differentiation of men from women. Those in which the males showed greater interest than the females were then tabled in descending order of chi-squares. A corresponding table was made for those in which the proportion of women declaring interest was greater. Daniel then set up a table of the distribution of these one hundred chi-squares and tested the departure of this distribution from that which would be yielded by random samples in harmony with the null hypothesis according to the mathematically known distribution of chi-square. This same procedure was used by several other authors. Altho there is some plausibility to this procedure, it does not appear to the reviewer as appropriate for getting an over-all determination (if an over-all is really needed) as additive chi-square would be; and certainly it is more laborious.

Beery (5) had 953 respondents from six different type groups indicate agreement or disagreement on 276 propositions regarding the implications of democracy, the items being divided into three random forms. Within each of these six groups he made t^2 tests to investigate the hypothesis of a fifty-fifty agreement or rejection. Then he made an over-all test by adding these t^2 's for a composite chi-square. This was a correct procedure. Beery appears to be one of the very few researchers who recognizes that, for one degree of freedom when dealing with frequencies, chi is identical with t as a deviate in a normal distribution when used for testing the same hypothesis. Other researchers reporting during the cycle (e.g. 82) put the test of proportions arising out of frequencies in terms of chi-square with one degree of freedom even when addressing readers who could not be expected to understand this statistic, apparently believing that there is greater exactness in the distribution of chi-square than in that of the critical ratio from proportions, or differences between proportions. In fact, when the standard error formula for differences between proportions is correctly stated and applied (with the p made the hypothetically true one or made as a pooled estimate from the sample) the standard error ratio from it interpreted from the normal curve table is identical with that from chi-square to the hundredth decimal place and beyond. Students of elementary statistics know that the distribution of proportions, and of differences between proportions, is not normal, particularly when p is small; and they employ the normal tables for interpreting the critical ratios from them with apologies. It is only because the distribution of chi as tabled assumes an infinite N (where

N is the total number of observations in the sample, in contrast with n which is based upon the number of cells into which the total N is grouped) that its curve is smooth instead of a polygon and that its distribution is normal regardless of the p ; for all samples less than infinite in size the distribution of chi (and of chi-square) has exactly the same limitations as those of the critical ratio from proportions or differences between proportions. The two are algebraically identical. If researchers could get over the false sense of security arising from lack of information about the assumptions back of the chi-square distribution, they might wish to make less use of that statistic where more straight-forward alternatives, or alternatives with a more constructive meaning, are available, such as differences between proportions or tetrachoric correlation coefficients.

Arsenian (2) and Lange (45) employed mean-square contingency correlation coefficients, using chi-square as their foundation. Among others employing the chi-square technic were Drummond (18), Everote (19), Hunnicutt (30), Katona (36), and Postman and Murphy (62).

Many miscellaneous technics departing from the well-known conventional ones were employed. Some of these involved interpretations or transformations of the correlation coefficient so as to supplement its customary interpretation. LaGrone (43) supplemented r 's by showing the difference between means of a dependent factor when classified into uppermost and lowest quarters on the independent one. Strang (73) showed means and standard deviations of classes arranged in hierarchial order where customarily coefficients of correlation would have been employed. Many writers transformed correlation coefficients into their corresponding hyperbolic arc-tangents (z) before working with their reliabilities. Swensen (74) correlated difficulty values of one hundred arithmetic items after training with difficulty values before training in three different groups drilled by different methods, with the purpose of comparing the change between before and after r 's among the three groups. For this comparison she transformed the r 's into z 's and obtained the standard error of the difference by the conventional standard error formula for random groups—a necessary formula here because the correlation coefficient needed for the third term where arrays are matched (as they were here in each before-and-after) is not known in the case of z . DiMichael (16) working with a problem that required the reliability of differences between r 's, employed the correct formula involving the correlation between the r 's for matched arrays. DiMichael gained more precision by using the correct formula without transformation than Swensen did by the slight advantage from the transformation when made at the expense of the impossibility of using the correct formula for the standard error of the difference. Fahey (20) displayed both correlation ratios and correlation coefficients for numbers of questions asked by pupils in class and twenty-three factors such as age, IQ, grade in course, and reading comprehension, and found the eta's differ markedly in many instances from the r 's.

Woodrow (87) made a multiple factor analysis of the intercorrelations among six school subjects in Grade V, VI, and VII in two cities, finding no general factor and group factors with only low communalities. Conant (10) used multiple factor analysis on reading tests. Bayle (4) investigated regressive eye movements in reading by studying the several patterns into which the behaviors seemed to fall. Knipp (39) made a survey of the methods and designs employed in experiments on the teaching of arithmetic from 1911 to 1940. Cook (11) studied the stratification of a tenth-grade class by a type of sociometric technic of which educational researchers would do well to take cognizance. Selover (70) and Baten and Hatcher (3) used Fisher's discriminant function.

Several experimenters used a plurality of pairs of *classes* in their studies rather than merely pairs of individual subjects. Some of these give evidence on the inconsistency of the outcomes in the several schools. Anderson, Marcham, and Dunn (1) employed a "telling" method of instruction versus a "doing" method in fourteen pairs of classes in eight different towns in seventh grade, and another twelve pairs of classes in Grade X. Of the eighty-four differences forty favored the telling method and forty-four the doing. No evidence was given of the significance of the differences as indicated by the schools separately, but the differences were in many cases substantial and probably would have separately suggested statistical significance. Stewart (72) also used in his study twenty pairs of classes in Illinois, Iowa, and Minnesota to investigate the effect of teaching diagramming upon certain other English masteries, using a three-part analysis of variance. None of the *F*'s was significant. No showing is made regarding the schools individually, but the fact that the *MXS* variance was considerable suggests that the schools must have differed greatly in the effectiveness of the two methods. Wrightstone (89) likewise reported the New York experiments on the activity program in terms of paired classes instead of paired individuals. Altho all but three of twenty-four differences favored the activity program, the *t* ratios were, in two-thirds of the comparisons, low enough to suggest much inconsistency in the findings from school to school. The study of separate schools in a replicated experiment is a practice to be encouraged, and may turn out to have a marked bearing on the issue to be stated in our next paragraph.

Studies with No Inferences about Population Values

A very large number of studies are intended to meet an immediate local problem and make no effort to draw inferences about where the "true" values (parameters) in a parent population lie. Sometimes this occurs because the author is unsophisticated in statistics, or because he is writing for an unsophisticated audience. In many cases the studies are made and written up by persons of high standing in research who are quite able to employ refined statistical procedures if they wish (*e.g.*, 25, 77, 78, 86). Apparently, influenced by such evidences as those referred

to in our preceding paragraph and by other considerations, they have no great faith in the practical validity of the statistics of inference (in contrast with its purely mathematical validity). There is emerging a theory of education into which a science of education that attempts to mandate "proven" superiorities in methods of teaching or in values does not fit well (58). This progressive education type of theory holds that it is the right of each school and of each teacher and her pupils to choose and to plan their values and their methods themselves, not have them mandated by others, even by a "science of education." The only manner in which research can serve these schools is to *offer* the fact that certain other pupils have found certain values or certain methods good and to carry the suggestion that the pupils and teachers try them for themselves (58, Chapter VI). In such a setting the dynamics of the local situation are a more powerful factor than any average of success elsewhere and may be expected often to upset predictions based on other pupils. Where human beings cooperate in real groups the mathematical laws of probability in sampling never hold completely because these laws are predicated on independence among the elements; in a group, social beings tend to be drawn into a certain degree of solidarity, and even in the relatively unsocialized schools of the past this socializing dynamic doubtless often upset the theory of sampling. But as the democratic movement in education sweeps onward, this dynamic socializing force within classroom groups may so completely overturn a theory of probability based on the assumption of independence among the individuals as to give to the statistics of inference a very different and less important status than it has seemed to have previously, and a very different status from that which it will continue to have in such fields as agriculture. For this new educational condition teachers can offer to one another *descriptions* of what they did and how it worked out for them; but to assert its probable goodness for an infinite population, and to offer it thus as an implied mandate in a science of education, will be far more presumptuous than it was in the days of the made-in-advance school, where pupils waited to be manipulated by their teachers and teachers waited to be manipulated by their supervisors.

Another mark of the tendency to make educational research serve local needs rather than to build a pure science of education is revealed by the large number of doctors' dissertations that construct local programs by implementing in action theories of education. Of the 1364 doctors' dissertation topics reported to Good (24) during the three-year period, the titles of at least 142 indicate that they are of this nature. The immense number of well-controlled inductive studies which constitute the findings of a science of education have done relatively little to affect classroom practice thruout the country, at least directly; for they have lain on shelves unknown by the rank and file of teachers. The constructive projects of local application are likely to be put to use at least in the communities for which they were made.

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CHAPTER V

Observational Methods of Research

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THIS chapter reviews methods of research based upon survey technics, the use of questionnaires, interviews, ratings and rating scales, case studies, autobiography, direct observation, and instrumental recording. Material is drawn from several related fields which use these research instruments as well as from educational research proper. Transferability of method to problems in educational research has been the chief criterion in the selection of references.

Survey Technics

General

The basic aspects of research thru surveys include the instrument or vehicle of data collection, the method of collection; the definition and selection of the survey population or sample; the methods and technics of summarizing and analyzing data; and the textual, tabular, and graphic presentation of results. The large-scale data collection problems involved in the administration of important wartime government controls gave rise to the development of special skills and procedures by those who directed these projects. Three agencies published manuals on surveys and form design methods (72, 73, 96, 97).

The Office of Price Administration published two manuals, described by Sells (79). The first (72) dealt with substantive issues in survey planning and design, presenting criteria and rules governing the relationship of form and survey design to objectives, elimination of unnecessary items, simplification of respondent's task and reduction of response time, principles for achieving simplicity of questions and improving respondent's understanding of his task, statistical planning (including statistical design, objectivity of questions, methods of data collection, sampling plan and tabulation plan), and administrative factors of cost, timing, utilization and application of results, and public relations. The other OPA manual (73) covers mechanical problems of form design, media of duplication, paper, type, special mechanical features, and form standardization.

Deming (25) with Bureau of Census experience as a background analyzed the main factors affecting the accuracy and usefulness of surveys. His list of thirteen sources of error, while slightly repetitive, due to the nature of the material, has been found useful:

1. Variability in response
2. Differences between different degrees and kinds of canvass
 - a. Direct versus indirect interview
 - b. Intensive versus extensive interview

- c. Long versus short schedules
- d. Check block plan (checklist) versus (free) response
3. Bias and variation arising from the interviewer
4. Bias of the auspices
5. Imperfections in the design of the questionnaire and tabulation plans
 - a. Omitting questions that would be illuminating to the interpretation of other questions
 - b. Wrong wording, eliciting an answer liable to misinterpretation
 - c. Forcing the respondent into a pattern
 - d. Failing to perceive what tabulations would be most significant
6. Changes that take place in the universe before tabulations are available
7. Bias arising from nonresponse (including omissions)
8. Bias of late reports
9. Bias arising from an unrepresentative selection of date for the survey
10. Bias arising from an unrepresentative selection of respondents
11. Sampling errors and biases
12. Processing errors
 - a. Coding
 - b. Editing
 - c. Machine and tally errors
 - d. Posting and consolidating
13. Errors in interpretation
 - a. Bias arising from bad curve fitting or adjusting
 - b. Misunderstanding the questionnaire—failure to take account of the respondent's difficulties (often through inadequate presentation of data), misunderstanding the method of collection and the nature of the data
 - c. Personal bias in interpretation.

Consumer Interviewing—Opinion and Market Research

Blankenship (17), Cantril (19), and Gallup (35) have written books presenting comprehensive analyses of the problems and technics in market research and public opinion polling.

Technical papers have dealt principally with factors affecting reliability and validity of data. Hilgard and Payne (48) compared the characteristics of persons found at home with those not at home when the interviewer called. They concluded that "people easily found at home on the first call differ significantly from those found at home only after repeated calls. The latter occur in large enough proportions to make it important for repeated calls to be made in order to represent them in sample surveys." Lazarsfeld (62) outlined six main functions of the open-ended interview (as contrasted with the yes-no, multiple-choice, or checklist types). These deal with clarification of interviewer's answer, singling out decisive aspects of his opinion, its relationships and motivation. More complete replies aid in interpreting statistical relationships. Gosnell and de Grazia (42) analyzed errors arising from polling interviews and means of reducing them. They cite as sources of error: interpersonal tension caused by respondent's sense of insecurity; economic, educational, racial, and nationalistic differences between interviewer and respondent; and excitement level, consideration time, and political party activities.

Studies by Friedman (34), Katz (56), Stanton and Baker (83), and Udow (95) on interviewer bias indicated that the significance of this factor varies in different situations. Stanton and Baker, using nonsense geometric figures in a recall experiment, introduced interviewer bias experimentally by giving the interviewers the correct answer "key." They found that the bias of the interviewer exerts some determining effect upon the outcome of the interview even when the interviewer is experienced, the direction of the bias is known to him, and the material has no personal or emotional connotation. The effect of the bias was found to be more pronounced upon incompletely learned, or remembered, material. They assumed, pending further study, that minimal cues and errors in recording might account in part for the results. However, Friedman, using a different procedure, failed to confirm Stanton's and Baker's findings. Katz obtained different poll results on labor and war issues when he used two sets of interviewers, one trained white-collar group and one experimental working-class group, on the same survey, working with identical instructions. He concluded that social status of the interviewers influenced the findings. Udow, in two market research and opinion surveys, found that neither the interviewers' own opinions nor their knowledge of the sponsorship were significant variables in the results.

Rugg and Cantril (78) found that "the extent to which the wording of questions affects the answers obtained depends almost entirely on the degree to which the respondent's mental context is solidly structured." People who lack reliable and consistent frames of reference "are highly suggestible to the implications of phrases, statements, innuendoes, or symbols of any kind that may serve as clues to help them make up their minds." Questions which bluntly state some deviation from an established norm are less likely to receive favorable replies than questions which imply the same deviation but state it more by implication. Where a new and somewhat complicated problem is to be posed about which people have thought little, the free-answer type of question should be used. "The split-ballot technic should be used wherever possible to test stability and consistency of opinion by noting the effect of . . . variation between free and prescribed responses."

The strength of drives to win approval or to avoid social disapproval were found by Gordon and Davidoff (41) to cause serious dishonesty and hence unreliability of scores on adjustment questionnaires.

Stonborough (86) described the advantages over other methods of market research of a continuous controlled sample of consumers who are motivated to keep a careful diary record of purchases. The consumer panel technic is valuable for many problems in educational and social research.

Ratings and Rating Scales

Teacher ratings—Barr and Harris (12) developed a teachers' performance record which provided a record of the observable behavior of teachers

and pupils and the data necessary for an evaluation of what is observed. It contains space for recording teacher and pupil activities, entries relative to their evaluation, and a scale for evaluating the personal fitness of the teacher. Baller (11) developed a case study instrument for evaluating teachers' understanding of child growth and development, entitled "The Case of Mickey Murphy." It presents a child development situation which would reveal, in the interpretations and recommendations which teachers in training give it, something about their understanding of growth and development. Smalzried and Remmers (81) applied the Thurstone method of factor analysis to student ratings of faculty members on the Purdue Rating Scale. This analysis produced two factors, designated Empathy and Professional Maturity. Empathy correlates highly with fairness in grading, personal appearance, sympathetic attitude toward students, and liberal and progressive attitude, while the greater factor loading for Professional Maturity is accounted for by self-reliance, confidence, and presentation of subjectmatter. Haggard (43) found that college freshmen ranked ability in teaching and organization of subjectmatter highest among characteristics of a desirable teacher, while appearance was ranked lowest. Freshmen, as compared with seniors, placed more emphasis on characteristics related to human relationship of teaching. Henrikson (47) found that ratings of voice exercised a strong halo effect on teacher efficiency ratings made by practice teaching and public-school supervisors.

Course ratings and evaluation of outcomes—Marzolf (66) had sixty-one statements, descriptive of possible outcomes of a teacher education course, rated as to desirability by 275 students and thirty-three faculty members of a state normal university. He reported median rating, rank, and Q for each item. Johnson (54) obtained replies from 12,425 graduates of Chicago high schools on a follow-up questionnaire designed to determine evaluations of the assistance of schooling in relations with people, in jobs and in subsequent education. The replies stressed "assistance in English and speech" and "training in vocations." Dexter (26) published a third revision of a questionnaire, intended to be used as an objective, anonymous instrument for a student's evaluation of a college course of study. It covers text, lectures, laboratory, field trips, quizzes, examinations, class discussions requirements, and general evaluation.

Speech ratings—Thompson (89) conducted a series of experiments on devices for measuring public speeches. Using college student audiences he found that the paired-comparison method is superior to rank order, and that a linear scale is about as accurate as letter grades, a "descriptive letter scale," the Bryan-Wilke scale, a Thurstone-type attitude scale. Because practice in rating has little effect and raters differ greatly in accuracy, individually and by groups, he concluded that further research should focus upon the raters rather than the methods.

Home environment and socio-economic status scales—Lundberg and Friedman (65) scored 232 families in a rural Vermont township on the

Chapin, Guttman-Chapin, and Sewell scales. High intercorrelations were found. The report also discussed discrepancies between the scales. Sewell (80) reported a correlation of .94 between a new fourteen-item scale and his longer form. The reliability of the short form ranged from .81 to .87. Kerr (58) reported the construction and statistical analysis of a home environment scale designed for group administration. Reliabilities from .84 to .91 were found and a high degree of validity. Items are grouped statistically into four sections: cultural, aesthetic, economic, and miscellaneous. Cantril (19) analyzed self-ratings of social and economic status, interviewers' ratings, and reported income data of a representative cross section of the national population. His results indicated that the majority tend to identify themselves socially and economically with the middle class, that there is no one-to-one correspondence between social and economic identification, that the lower income groups tend most toward middle-class social identification, that there is a tendency to regard one's social class as higher than one's economic class, and that the disparity between social and economic identification increases up the social and down the income scale. Woofter (103) presented a technic for analysis of family composition and income, using as a yardstick the median per capita of the population.

Behavior rating scales—Several new scales, inventories, and activities inventories have been reported: Cox and Anderson (23), Harris (46), Kopel (61), Mooney (67), and Smith (82). Tschechtelin (93) had 166 children rate themselves and had six fellow pupils and four teachers rate them on both the Kelly 36-trait personality rating scale and the Tschechtelin 22-trait personality rating scale. The two scales had average correlations of .85 for teachers' ratings, .76 for pupils' ratings, and .64 for self-ratings. She concluded that this indicates that these child and adult scales were highly comparable and may, therefore, be used in systematic scientific investigations of pupil and teacher personalities. Cox and Anderson (23) studied teachers' responses to problem situations in a high school by obtaining teachers' and students' responses to a list of items selected from a mental-hygiene scale for teachers. They found that, both by teachers' reports for themselves and by students' reports of the teachers' technics, the teachers in general either defeat their own purposes by making the problem worse or they use technics unrelated to the problem.

Job ratings—Moore (68) criticized four types of job evaluation: job classification, job ranking, job elements, and point evaluation, which are most widely used. This paper outlines the principal steps in point evaluation together with an estimate of the validity of the technics. Stigers and Reed (85) outlined a complete system of job evaluation. This consists of three steps: analyzing the factors, measuring their strength or value in terms of points, and converting the point values into money values. A new element, called "accuracy of motion and/or position" has been added to the thirty-five presented earlier. After an element is identified in a job, a questionnaire is filled out to discover how it affects

the job. Based on this information, point values are determined by means of a rating scale or table.

Employee service and efficiency ratings—There has been a definite recognition of the value of efficiency ratings for guidance as well as administrative uses. This is recognized in the contributions of Halsey (44), Moore (69), Watkins (98), and Zerga (105). New contributions to method stress methods of development of rating forms, self-ratings, administration, interpretation of results, record keeping, and use in employee-management relations. Steinmetz (84) and Fear and Jordan (29) have published new instruments. Zerga (105) reviewed the merit rating systems in use in a number of large industrial organizations. Halsey (44) and Watkins (98) reviewed merit systems used by governmental organizations. Tiffin and Musser (91) suggested the use of Z-scores to weigh merit rating items.

Other research using rating technics—Sumner and Clark (88) found that fifty-two adult Negro judges were unable either before or after a standardized individual interview effectively to rank seven Negro college freshmen as to estimated test intelligence. Kay (57) analyzed the effects of stereotypes and prestige suggestion on college students' rankings of the prestige value of twelve occupations. Eysenck (28) applied the psychophysical method of direct comparisons to the measurement of aversions and satisfactions. Howard (49) analyzed the complexity of mental processes in science testing by having college professors and graduate students rate 180 items in the Cooperative General Science Test according to complexity (from mere memorization to complex integration of information). Thorndike (90) analyzed the ratings of 155 teachers of the extent of the contribution made by their studies and occupations to their general intellectual and character training and their interest in these activities. Abramson (1) studied the ratings by forty-nine high-school graduates of the formative influence upon vocational choice of twenty possible factors.

Interviews

Interviewing is an important technic of evaluation, guidance, data collection, and therapy. Principles of good technic are common to all of these applications. Several contributions to interviewing technic have appeared: Fearing and Fearing (30), Fenton (31), Garrett (36), Otis (74), Porter (75, 76), and Williams (102) described the basic instructions used by interviewers of the National Opinion Research Center. This covers selection of respondents' approach, attitudes, types of answers, place of interview, and supplementary information. Edmiston (27) described the use of the group interview technic in appraising the professional program in New York State teachers colleges. Freeman (33) described the essentials of the "stress interview" in selection of employes. This technic contains five parts: nonstress questioning, nonstress action, stress question-

ing, stress action, and post-stress questioning. An examining board rates the applicant on a series of rating scales.

Child (21) described the treatment of data obtained in a study of the reactions of individuals in an acculturating group as an illustration of several methodological points in the use of interviews. First, certain controls can be introduced to insure much objectivity in analysis of data. Second, interview data can be used for construction of quantitative scales comparable to those commonly derived from tests and questionnaires. Third, interviews afford a total evaluation of the individual subject which yields conclusions not as easily accessible to quantitative technics.

King (60) reported the use of idea-centered questions in interview schedules. A free method of wording questions was used, while attempting to state clearly the ideas and issues involved. Reliability, measured by returns of two interviewers, was satisfactory.

Franz (32) analyzed the similarity of Moreno's psychodrama technic to interviewing as a research aid. It has the advantage of reducing the possibility of concealment of facts and of allowing data to be gathered in a life-like situation.

Strang (87) and Young (104) studied reading interests of school children thru personal interviews.

Anecdotal Records, Case Studies, Autobiography, and Direct Observation

Hamalainen (45) studied the effectiveness of anecdotal records of behavior in and out of the classroom as a basis for teacher appraisal of pupils. He compared teachers' rankings of pupils on the basis of anecdotes with ranks on several standardized tests of interests, achievement, social studies, and personality. He concluded that teachers are able substantially to judge pupil social relationships after using anecdotal records; the anecdotes revealed interests and interest changes not shown in the Hildreth inventory; the success of the anecdotal method is dependent upon the outlook and training of the teacher and the type of the educational program. Gaw (37), with reference to records for use by the dean of women, stressed the need for divorcing descriptive material from inferences and for using all available autobiographical material.

Three studies discussed quantitative technics for treating qualitative data. Wherry (101) outlined a method whereby biographical or other qualitative data may be used to predict success or failure on an independent criterion. This is a least squares equation with a transformation equation for punch-card coding. Bittner (16) used the Wherry-Doolittle technic to predict college entrance from qualitative biographical questionnaire responses. Jones (55) described methods for describing and summarizing socially significant factors in motion pictures.

Ludeke and Inglis (64) developed a technic for validating interview data on portions of a magazine read by checking reports against records made by observers thru concealed one-way vision screens.

Arrington (8) published a comprehensive review of methodological and behavioral findings using the time sampling technic. This is a method of observing the behavior of individuals or groups under ordinary conditions of everyday life in which observations are made in a series of short time periods so distributed as to afford a representative sampling of the behavior under observation. Chin (22) studied conformity behavior by recording the time of arrival of college students at a nine o'clock class over several weeks. By means of a questionnaire he isolated some of the factors affecting the distributions obtained.

Direct observation of behavior, while expensive in time and personnel, is nevertheless one of the richest sources of information. Bell (14) made observational records of ninety-three children aged three to eight during periods of dental treatment in clinics, recording the dentists' behavior concurrently. The results, supplemented by interviews with the children and their parents, disclosed needs for training parents regarding children's dental needs and behavior and for training dentists in the guidance of child patients. Studied by Appel (7), Arsenian (9), Baruch and Wilcox (13), and Bonte and Musgrove (18) of children of nursery-school and preschool ages, illustrate the value of observational methods in the study of aggressive behavior, personal and social adjustment, personality development, and play activities. Biber and others (15) developed a general summary of behavior characteristics of a seven-year-old group, using as sources recorded observations of work and play activities, spontaneous behavior, and expressed opinions, supplemented by objective and test data. Nesbitt (71) analyzed problems of student nursery-school teachers using observational records of their actual performance. Moorhead and Pond (70) reported the results of a five-and-a-half-year study of spontaneous music behavior of children aged two to six. They concluded that the "program-music" concept of children's music (story telling and picture painting) is too narrow.

The Use of Instruments and Machines

In almost every field of human endeavor, machinery now accomplishes much of the work previously performed by human beings, and instruments have substituted accurate quantitative measurement for inaccurate evaluations based on subjective judgment. However, the process of education has been influenced only indirectly for the most part by the trend towards the greater use of machines. Apart from the occasional use of the movie projector or the radio, the most important use of instruments and mechanical devices in education is to facilitate measurement, and particularly the measurement of sensory thresholds and the measurement of abilities and aptitudes.

The need for an accurate mechanical device for scoring objective tests has been recognized for nearly two decades. Amongst the precursors of the modern scoring machine is one developed by Pressey in 1932 (77).

This device like all other test scoring machines required the use of a separate answer sheet. The student was required to punch out the correct answer on the answer sheet. The correctly punched holes were picked up by the scoring machine thru catching in a pinion gear as it moved across the answer sheet. Another type of mechanical scoring machine was developed by Cuff (24), and also required the use of an answer sheet in which the answers were punched out by the examinee. In Cuff's machine, scoring was accomplished by placing the answer sheet in a frame which was held rigidly over the platform of a scale. Weights were lowered over the positions in the answer sheets which corresponded to the correct answers. If an answer was correctly punched, one-fourth ounce weight passed thru the hole in the answer sheet and depressed the platform of the balance by a small amount. The total number of correct answers could be determined by reading the scale of the weighing machine which was graduated in one-fourth ounce units.

The present type of test-scoring machine in common use developed by the International Business Machines Corporation is well known (51, 52). However, it should be noted that this machine has an advantage over previous devices since it can be used for making rapid item analyses and can be used for a number of other varied purposes.

Lorge (63) has reviewed the applications of the International Business Machines to educational research. In this number of the REVIEW, he has reviewed some further applications of the tabulator, sorter, multiplier, test-scoring machine, and the graphic item counter (Chapter 5). A useful bibliography of recent applications of I. B. M. equipment has been published by I. B. M. (50). A recent adaptation of I. B. M. punched-card equipment for recording responses in a multiple choice situation was made by Gaylord (38) who adapted a numerical hand punch so that subjects recorded their responses by punching holes in an I. B. M. card.

Much mechanical ingenuity has been devoted to the development of instruments for diagnosing reading difficulties and for providing remedial treatment. The Ophthalmograph (3, 4, 5, 6) designed by the American Optical Company is in essence a camera adapted for photographing eye movements during reading. The Metronoscope (5, 6) produced by the same company is a device for training readers by pacing eye movements, preventing regressions, and establishing rythmical left-to-right movements of the eyes. A simpler portable instrument, the Junior Metronoscope, (2) also includes the necessary optical mechanism for corrective work in connection with inadequate oculo-motor coordination and fusional difficulties. While these devices are mechanically well designed, there is as yet no indisputable evidence that the results achieved with them are greatly superior to those achieved without them. Traxler (92) surveyed the literature on controlled reading and concluded that the results of research do not provide clear-cut evidence, favorable or unfavorable, to controlled reading. However, Traxler added that the evidence tends to be on the favorable side toward the use of instruments of the type described.

The traditional device for measuring visual acuity, the Snellen chart, is now recognized as having limited value. Two new devices are now available for this purpose which overcome many of the weaknesses inherent in the old letter-reading test and provide tests for a much wider range of visual functions. One of these, the Orthorater (53) provides measures of visual acuity for both distant and near vision and in addition enables the examiner to test for phorias, depth perception, and color perception. Another instrument of modern design for measuring visual acuity is the Telebinocular (59) which provides measures of visual acuity both for near and far vision. The telebinocular test series is given with both eyes open and it is possible to determine whether the subject is suppressing or blocking vision in one eye. It is also possible to study with this instrument problems of fusion and lateral imbalance. Both the Orthorater and the Telebinocular can be used satisfactorily with illiterates.

The modern type of audiometer is slowly replacing the discredited whisper test. At the present time the Western Electric Company produces two types of audiometers, the four-type audiometer and the six-type audiometer. The most recent model of the four-type is the 4C audiometer (100) which is a phonograph to which forty earphones may be attached. Each subject applies an earphone to the ear to be tested and records on a piece of paper the digits which he hears. Phonograph discs with two-number digits recorded on them are used for testing the hearing of children below the fifth grade, and discs with three-digit numbers are used for testing older children and adults. If a more complete diagnosis of hearing losses is required, then the 6B audiometer (99) may be used. This latter instrument permits the testing of auditory acuity at any desired frequency from 128 to 9747 cycles per second. The 6B instrument also enables the examiner to test bone-conduction losses in each ear separately.

In the field of speech training, some use has been made of voice recording instruments as training devices. However, relatively few systematic researches into speech problems have made use of such speech recordings. Gilkinson (39) reviewed 354 studies in speech and noted only two studies in which such records were used. A notable example of the use of speech records in research is provided in a study by Goldstein (40) who investigated the relation between speed of speech and comprehension.

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CHAPTER VI

Tests and Measurement

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CONDENSATION into one chapter of material equivalent to that covered by Greene, Jorgensen, and Gerberich (56) in the December 1938 issue of this REVIEW has necessitated arbitrary decisions concerning types of material to be reviewed. This report, therefore, is limited to literature, concerned mainly with the measurement of relatively tangible instructional outcomes and the interpretation and guidance uses of results from such measurement. In a recent issue of this REVIEW (45), Cornell (22) and Traxler (115) reviewed the construction of, and Freeman (52) and Darley (28), the application of results from, respectively, tests of intelligence and measurements of personality and character, and Sells (100) dealt with the measurement and prediction of abilities.

General Textbooks and Reference Sources

Greene, Jorgensen, and Gerberich (55, 56) wrote complete revisions of the two general texts for the elementary school and the secondary school which appeared in the middle thirties under the authorship of Greene and Jorgensen. Remmers and Gage (93) brought out a book on measurement and evaluation, and Darley (29) wrote on testing and counseling in the guidance program of the high school. Brereton (13) furnished general and historical backgrounds and proposed reforms for the examination system in English schools.

Greene and Crawford (54) revised the Greene workbook in educational measurement and evaluation. McKown (80) wrote for the benefit of students on how to pass a written examination. Swineford and Holzinger (109, 110, 111) continued their annual reviews of periodical literature on the theory of test construction.

Problems Involved in Educational Measurement

Scates (98) outlined five major respects in which scientists and measurement specialists differ markedly from the classroom teacher in their criteria of measurement. He generalized that measurement specialists, thru their primary interest in details, specifics, and formalities, have largely failed in standardized tests to attain measurement of the totality of behavior with which the teacher is directly concerned. The five major differences listed and discussed are:

1. The *demand for rigor*; the scientist seeks truth and broad generalizations, while the teacher seeks information of direct, practical value.
2. The *approach to complexity*; the scientist is interested in elements, whereas the teacher is interested in functioning organisms.

3. The *attitude toward immediacy*; the measurement specialist cannot measure continuously, but the teacher needs to and must measure continuously.

4. The *concept of human development*; the scientist measures traits uniform thruout their range, but the teacher measures growth in stages.

5. The *attitude toward vital aspects of learning*, the measurement specialist generally measures formal abilities by cross-sectional power tests, but the teacher must be concerned with behavioral dynamics and abilities in life situations.

Bloom (11) and Traxler (118) discussed major problems encountered by the educational test worker. Sims (102) pointed out some of the ways in which educational measurements could contribute more effectively to the broad evaluation of pupil behavior which is so important in the modern school. Pitfalls in the use of tests were pointed out by Kirkendall (70), and Dunkel (36) discussed misconceptions concerning measurement and evaluation.

Saucier (97) critically analyzed statements made about and defenses given by test specialists for objective tests, and MacNeill (82) defended the essay examination for achievement testing.

Trends in Educational Measurement

Trends and tendencies in measurement continue to develop slowly but unmistakably in the direction of more functional and less formal tests and more intelligent use of measurement results. Monroe (83) pointed out that altho the "battle" for objective tests in educational measurement was won before 1920, growth of the measurement movement from 1920 to 1945 represented progress from early adolescence to early adulthood. A symposium of the Committee on Measurement and Guidance of the American Council on Education (112) pointed up many uses of test results far beyond those conceived a decade ago.

Evidence concerning direct effects of World War II appeared in a discussion by Segel (99) of six major and three minor trends in testing and in a survey (38) of inquiries concerning testing and guidance services received by the Occupational Information and Guidance Service, Federal Security Agency.

Construction of Instruments for Measuring Achievement

Attention to the construction of tests measuring functional behavior rather than subjectmatter knowledges and understandings has doubtless been stimulated of late by Smith and others' (103) report of testing procedures in the Eight-Year Evaluation Study. At least two standardized tests (50, 133) have dealt with behavior in this broad sense.

Fordyce (49) and Yauch (144) presented suggestions concerning the construction of functional rather than formal tests by teachers and by committees. Engelhart (40, 41) illustrated and discussed several unique test exercises. Rath (92) reported on the development of a test of thinking by teachers, and Roody (95) discussed a plot-completion test of signifi-

cance in personality measurement. An experiment with pupil-made test items in seventh-grade history was conducted by Early (37).

At a somewhat more technical level, Smith (104) traced the steps in constructing and validating a general information test for preschool age children; Anderson (5) developed a technic based on that of the Stanford-Binet for achievement testing in psychology; and Pace (86) discussed and gave examples from a test designed to relate educational theory and practice. Kaulfers (69) based his technic for measuring oral fluency in modern foreign languages on the experiences of the armed services in World War II.

Validity and Reliability of Achievement Measures

Statistical aspects of test construction with major concern for test and item validity and test reliability were treated by Fattu (44) and Conrad (20) in recent issues of this REVIEW. Articles of both general and technical nature now frequently use analysis of variance or factor analysis technics of research.

Test validation—Davis (32) discussed the relationships of achievement testing methods to course objectives and instructional emphases. Richardson (94) developed a simple procedure for determining test validity in terms of the increased efficiency of a selected group of personnel. Toops (114) used a "success profile" for validating a test, in determining scoring formulas and in weighing test parts, and presented a case for selecting the criteria before a test was administered as a substitute for the common self-validation methods. Sims (102) mentioned the possibility of test validation on the basis of retention and significance for future growth of the test content. A three by three chart of relationships between aptitude scores and course marks was developed and illustrated by Krathwohl (71).

Item validation, difficulty, and scoring—Effects of item difficulty and chance successes on item and between-test correlations were studied by Carroll (16), who also developed a two by two table for relating data on item difficulty and chance successes. McNamara and Weitzman (81) investigated the difficulty of multiple-choice items in terms of the position of the correct response, and Grossnickle (57) studied the effects of example difficulties and arrangement upon scores in a test on division of decimals.

Copeland and Gilliland (21) compared reliabilities and validities of four basic objective item forms for the measurement of achievement in child psychology. Different forms of spelling tests were compared by Brody (15). Curtis, Darling, and Sherman (27) and Wright (143) studied a modified form of true-false item in science instruction. Methods of scoring rearrangement tests were reported by Rosander (96) and Odell (85). Casanova summarized literature on measurement of randomness in order of correct-response position (17) and developed formulas for using the method of runs in testing randomness of order (18) in objective

test items. Dickenson (35) presented a method for detecting cheating on tests having a definite number of responses per item by means of identical errors greater than would be accounted for by pure chance.

Test reliability—Cronbach (26) critically examined the split-half, rational equivalence or Kuder-Richardson "Footrule," and parallel-split methods of estimating test reliability. Jackson (65) determined relationships between estimates of reliability obtained by the internal-consistency and test-retest methods thru use of an analysis of variance technic. Lord (79) examined the influence of the number of alternatives per item upon the reliability of multiple-choice tests. An approximation method of factor analysis was applied to test items in the estimation of test reliability by Wherry and Gaylord (136).

Factors Affecting Test Scores and Test Performance

Influence is often exerted upon pupil test performance by such constant, often unrecognized factors as may occur in the test or in its motivation and by variable, often well-hidden factors reacting upon the individual child.

Tyler and Chalmers (125) studied the effect upon scores of advance warnings of tests to junior high-school pupils in general science. Plowman and Stroud (88) investigated the learning which resulted when pupils were informed concerning the correctness of their responses to objective test items.

The psychiatrist's approach was used by Liss (78) in studying pupil anxiety in examinations. Hastings (58) used a questionnaire in studying examination tensions and their relationship to scores on an achievement test. Waite (132) employed a laboratory method in determining the emotional responses occurring during the existence of a situation comparable to that of an examination. Test performance in relation to socioeconomic levels and persistence in the examination situation were studied by Fleming (48) and Briggs and Johnson (14) respectively. Pritchard (91) reported on the effect of ability in such motor skills as pencil manipulation on rate scores in arithmetic.

Evaluation of Testing Technics and Standardized Tests

Traxler (119) discussed seven problems encountered by the test maker in the field of reading, while Davis (31) outlined eight groups of skills desirable for measurement in a reading test. Wilking (138) suggested the use of the Roget *Thesaurus* classification of words into twenty-four categories distinguished by philosophical criteria as a basis for selecting vocabulary in reading tests and checked the Iowa Silent Reading Test vocabulary against this criterion. Cronbach (25) surveyed methods of vocabulary testing under five ability headings and considered the relative merits of different item forms for testing each type of ability.

The validity of tests in beginning reading was studied by Stone (107) in terms of their vocabulary load. Poston and Patrick (89) evaluated

word recognition tests using word and picture matching for pupils in the primary grades. Neill (84) analyzed the Latin-American content of standardized tests in the social studies and several other subject areas. Hendricks (59) and Woods and Martin (141) analyzed tests and testing practices in the areas of college chemistry and musical education respectively.

Tinker (113) and Blommers and Lindquist (10) investigated relationships between speed or rate of reading and comprehension in achievement test scores at the elementary- and secondary-school levels, and Barnes and Mouser (8) compared scores of high-school and university freshmen on a test of biological misconceptions. Learned (74) reported an extensive study in which he analyzed the cases of college seniors for whom a great discrepancy existed between course marks and scores on the Graduate Record Examination.

Interpretation and Use of Measurement Results

Jackson and Ferguson (66) pointed out the values of score distributions of U-shaped, J-shaped, bimodal, platykurtic, and leptokurtic types for serving certain specialized purposes in the interpretation of results. They recognized that statistical difficulties would arise in analyzing the results of such distributions, inasmuch as sampling error theory is largely based on the normal distribution.

Cornell (23) developed a procedure for obtaining age progress percentile norms by relating achievement levels to the ages of elementary-school pupils. Stevason (106) developed and illustrated a graphic method of converting test scores to marks on a five-point scale by methods based on the quartiles and on the standard deviation.

Among articles reporting general use of test results were those of Jones (68) and Darley (30) in personnel work of the high school and college respectively and that of Jacobson (67) by accrediting agencies. Traxler (121, 122) dealt broadly with the use of test results in diagnosis in the tool subjects and in the appraisal of personality. Lindquist (76) wrote on the interpretation and use of results from the Iowa Tests of Educational Development by the teacher. Traxler (117) wrote on individual evaluation.

Sells (101) and Strang (108), respectively, discussed the use of educational and psychological test results and of data on reading ability, habits, and interests in cumulative pupil records. Ewing (42) reported findings concerning the use of standardized reading tests by teachers colleges, and Triggs (124) reported on diagnostic test results as basic to the correction of spelling deficiencies of college students.

Credit by Examination before World War II

College credits have been awarded upon the basis of satisfactory performance on comprehensive achievement examinations in some institu-

tions for as long as fifteen years, and the movement toward the awarding of credits for demonstrated masteries acquired informally rather than solely upon the basis of time serving in classes has gained impetus during the last few years. Pressey (90) justified this method of earning credits and recommended that the plan be accepted as a major academic procedure.

Credit by Examination and In-Service Course Tests of World War II

Not long after the entry of the United States into World War II the American Council on Education, wishing to forestall the type of unreasonable and harmful awarding of "blanket" credit which followed World War I, called a special conference to develop policies and procedures for evaluating educational proficiencies developed by men and women in the armed forces. A recommended program (4), formulated by the Council working in cooperation with the armed forces, outlined the types of experiences gained in the armed services, indicated the desirable types of examinations for evaluating learning outcomes and suggested a course of action appropriate for American secondary schools and colleges. Tyler (127, 128, 129) and Lindquist (77) furnished progress reports for the program in general, and a committee representing the secondary schools (19) and a symposium for the colleges (130) interpreted its implications for institutions at these two levels.

In an expandible publication at present in loose-leaf form (2) the American Council on Education provided the framework for the operation of a program including not only accreditation of informally acquired proficiencies by examination but also for acceptance of credit for the formal learning experiences gained in the service training programs of the various armed service branches, the specialized training programs (such as the ASTP and Navy V-12) conducted by contracting schools and colleges for the armed services, and the correspondence and self-teaching courses offered for off-duty time by the Armed Forces Institute and other educational agencies. The informal learning experiences recommended for accreditation by examination were classified as of three types: (a) direct observation and experience in countries visited, (b) experiences incidental to military services thru on-the-job fulfilment of duties after the completion of formal training, and (c) self-directed study and self-education thru reading, educational movies and lectures, and organized discussions.

The Armed Forces Institute provided three basic types of tests (1) the end-of-course tests for use with correspondence, self-teaching, and group-instruction courses, and the two types of tests—general educational development and subject or field—designed for measuring learning outcomes from informal experiences, plus a specialized series of tests in electronics (34) for measuring outcomes of highly technical training programs. The nine tests of educational development and the more than

seventy subject tests are available in two forms; the A form is reserved for the use of the Armed Forces Institute and of institutional examiners approved by the AFI, while the B form is commercially available (43) for use in establishing local norms or accrediting bases or for use as regular course examinations. Five tests for the secondary-school level of general educational development cover the areas of English, literature, natural sciences, social studies, and mathematics, and more than thirty tests in seven subject areas. Those for the college level include higher-level tests of general educational development in the first four areas listed for the secondary school and some forty subject tests in nine subject areas.

Descriptions of the various AFI tests of general educational development and subject or field series were provided by the American Council on Education (2). Recommendations were also provided concerning critical scores to be used in awarding or denying credit by institutions to which veterans apply, altho it is made clear that the accrediting institutions are free to set their own critical scores. Detchen (34) and Lindquist (77) reported on the standardization testing by means of which most of the recommended critical scores were established.

Reports on various aspects of some of these tests were made by Ashford (7) and Hered and Thelen (60) for those in chemistry, and by White and Enochs (137) for those in the reading and interpretation of literature. Crawford and Burnham (24) reported on the use of the general educational development battery with 135 civilian university students.

Selection, Classification, and Post-Service Testing of World War II

Selection and classification programs of various armed service branches have been treated rather extensively in the literature. Stalnaker and others (105) and Anderson and others (6) surveyed this aspect of testing in recent issues of this REVIEW, and Davis (33) treated such testing in the Army and Navy. Weitzman and Bedell (134) added to the less extensive reports of in-service achievement testing, and Williamson (139) wrote on the use of tests in the vocational and educational guidance of ex-service personnel.

Coordinated Testing Programs: Statewide, Regional, and National

Statewide programs—Coordinated testing programs on a statewide basis continue to serve a variety of purposes in widely different types of schools. Peterson (87) found that twenty-eight of the states have had at one time and nineteen of the states now have coordinated statewide testing programs. All pupils at the grade levels served participate in only eight of the nineteen states. A major or supplementary purpose in thirteen of the nineteen states is improvement in articulation between the high schools and the colleges. Commercially published tests are used in twelve

of the nineteen states and colleges or universities coordinate the programs in ten of the nineteen states.

Findley (46) reported upon the guiding principles in construction and the validity for predicting general academic achievement in New York colleges of the Comprehensive Examination for Scholarship Awards. Wood (140) and Woody and Gaten (142) described programs operating in Ohio and Michigan, respectively. Beers (9) outlined procedures used in administering, scoring, and reporting results for the university system of Georgia, and a similar report was made for the statewide program in Illinois (64).

Lindquist (75) listed several advantages of the statewide or regional program, using the Fall Testing Program for Iowa High Schools (131) as the primary bases for his interpretations. He expressed concern that not more states have instituted and carried thru such programs.

Regional programs—Testing services on a regional basis have so far been provided largely if not entirely in connection with the effective prosecution of World War II. The administration of the Army A-12 and Navy V-12 Qualifying Test for Civilians thru regional directors under one director for the nation was mentioned by Lindquist (75) as indicating the practicability of establishing regional programs under a central agency. He recommended that such programs provide flexibility thru the choice of any one of several "core" programs and thru supplementation by tests chosen or constructed locally.

National programs—Testing programs on a nationwide basis have so far been limited mainly to services for special groups of schools or to a relatively small number of cooperating schools. Hill (61) discussed possible modifications in the National Teacher Examinations. Learned traced the development of the Graduate Record Examination (73) and pointed out its uses in the educational placement of returning veterans (72). Traxler (116) reported on the Educational Records Bureau program. Other programs of nationwide scope are the medical aptitude tests of the American Association of Medical Colleges, the College Entrance Board Examinations, the National Freshman Placement Testing Program, the National College Sophomore Testing Program, and the College Chemistry Testing Program, all embodying one or both of the limitations mentioned above.

New York Times Test

No account of tests and measurements for the last three years would be complete unless the *Times* test received attention. The charge that "college freshmen thruout the nation revealed a striking ignorance of even the most elementary aspects of American history, and know almost nothing about many important phases of this country's growth and development," was made by Fine (47), who concluded that the secondary schools had failed signally in their responsibility for teaching American history. His evidence was obtained from the scores made by 7000 fresh-

man students in thirty-six colleges on a questionnaire prepared by Hugh Russell Fraser and Allan Nevins.

Congressmen, public officials, the press, and the public reacted promptly both in defense and in support of the attack. Educators who found the test weak or the interpretation of results faulty included Boyd (12), Elicker (39), Hunt (62), Traxler (120), and Tyler (126). Charges made by these educators dealt with biased or faulty motivation, administration, and scoring of the instrument, with ambiguities in questions, and with the factual nature and poor selection of content.

The public controversy was apparently concluded by a defense of the test and an attack upon its critics by Fraser (51), a pro and con treatment of the original interpretation of findings respectively by Hunt and Fine (63), and a report of the Committee on American History in Schools and Colleges of the American Historical Association, the Mississippi Valley Historical Association, and the National Council for the Social Studies (135). Altho this committee was appointed before the *Times* test was given, its report presented and interpreted results from a carefully constructed objective test on understanding of United States history. The committee pointed out that the findings did not support the conclusion of meager or ineffective instruction in high-school American history.

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CHAPTER VII

Statistical Theory: Some Recent Developments

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THE FIRST part of this chapter is devoted to a review of some recent developments in statistical theory. The review covers only the periodical literature which appeared from January 1943 to the present time. It has been divided into four somewhat overlapping subsections which, in order of presentation, treat questions of prediction, estimation and description, statistical inference in the nonparametric case, and other miscellaneous problems of statistical inference. An effort was made in the case of the first three subsections to provide sufficient detail to give the reader a general notion of certain recent developments without his having to refer to original sources. The relatively large number of articles covered in the last subsection made such a treatment impossible. The last subsection, therefore, reduces to little more than annotated bibliography.

Considerable difficulty was experienced in the selection of material which it was thought might be useful to educational research workers. Some of the theory reviewed has not yet been applied to problems of educational research and perhaps never can be. On the other hand, some of the theory not reviewed may in time prove to be of the greatest importance.

Finally, it should be noted that many phases of statistical theory are rapidly becoming highly abstract. Toward such phases of the theory the attitude of the practical statistician should be one of tolerance, for it is never known when the theory may provide new tools which are not only more widely applicable but also simpler to use.

The Prediction Problem

The needs of the armed forces have, during the past few years, forced new attention on the old problem of classifying individuals on the basis of test scores plus past experience. The problem may be summarized as follows: Given continuous scores on test l thru t for each of N individuals selected at random from a specified population, and also a continuous measure of the amount of some trait which past experience has shown each of these N individuals to possess; let it be required to establish a scheme for classifying other individuals selected from this population with reference to the trait involved when given only their scores on the t tests. The classical solution of this problem is, of course, provided by multiple regression.

A significant shortcoming of the multiple regression solution lies in the involved and laborious computational processes accompanying the determination of the multiple regression weights. A number of schemes for

approximating these weights have been suggested by Jackson (26). Using actual data, Jackson compared the effectiveness of each scheme, as measured by the correlation between the resulting estimated trait classification (usually called the predicted trait score) and the actual trait classification as based on past experience (usually called the criterion score), with the effectiveness of the classical least squares determination of these weights as measured by the multiple correlation coefficient. On the basis of this empirical evidence he concluded that no one of the suggested approximate methods was best under all conditions and selected from among these methods three which seemed most promising. His recommendation was that each of these methods be given a preliminary trial and that one of the three be selected which results in the highest correlation between predicted and criterion measures.

The least laborious of the three approximate methods recommended by Jackson requires the covariance between the scores on each test and the scores on the criterion, and the variance of the scores on each test. However, these same data represent the major part of the information required by the other two suggested methods, so that the joint trial of the three methods is not as laborious as might first be supposed. Since the multiple regression solution requires the complete matrix of covariances, it appears on paper, at least, that Jackson's suggestions accomplish the purpose intended.

Another important shortcoming of the classical multiple regression solution lies in the fact that very frequently no continuous measure of the trait (criterion) concerned is available thru past experience. In fact it is frequently impossible to obtain such a measure because of the nature of the trait involved. A problem arises, then, differing from the one previously stated only in the nature and extent of the information available thru past experience.

Some years ago Fisher¹ devised a procedure for estimating test weights in such a way that a linear combination of the weighted scores (called the discriminant function) would provide a maximum discrimination between two groups of individuals with reference to some trait. The only information needed in addition to the test scores was a knowledge, based on past experience, of the group to which each individual belonged—that is, did he or did he not possess the trait, or was he or was he not successful in accomplishing a given task. Because of the possible applicability of the discriminant function in psychological and educational work, Garrett (18) has provided a simple discussion of the theory underlying it. An important feature of the method is the provision of a test of the effectiveness with which the obtained discriminant function classifies the individuals. Garrett's presentation helped to clarify the procedure by showing its relationship to the multiple regression solution. By assigning scores of zero and one to the two classes and applying classical multiple

¹ Fisher, R. A. "The Statistical Utilization of Multiple Measurements," *Annals of Eugenics*, 1938.

regression procedures, he obtained a solution identical to that yielded by Fisher's method. When this was done the test of the significance of the multiple correlation coefficient was identical with Fisher's analysis of variance test of the significance of the discrimination provided by his solution. It should be noted that the method may be extended to situations in which past experience provides a classification of the individuals into more than two groups.

This same problem has been solved by Wald (51). Wald's approach required the same information as is required for use of the discriminant function, viz., measures on each of t tests for N_1 individuals drawn at random from one population, say category A (possessors or passers), and measures on the same t tests for N_2 individuals drawn at random from a second population, say category B (nonpossessors or failers). Wald derived a statistic (incidentally it may be noted that this statistic is proportional to the discriminant function) which may be used to test the hypothesis that a single individual drawn at random from population C, and for whom scores on the same t tests are available, is not a member of population A, it being known a priori that population C is identical with either population A or B. For large values of N_1 and N_2 the distribution of Wald's statistic is normal with a calculable mean and variance. Wald also provided the exact sampling distribution of his statistic for small values of N_1 and N_2 .

An interesting aspect of Wald's approach arises from the fact that there exists only a single allowable alternative hypothesis. This makes it possible to set up a critical region (i.e., a region containing values of the statistic which would occur a set proportion of the time if the hypothesis is true) so as to take into account both types of error. Suppose, for example, that W_1 and W_2 are two positive numbers expressing respectively the importance of an error of the first type (rejection of the hypothesis when it is true) and of the second type (accepting the hypothesis when the alternative is true). These values can, of course, only be established with reference to the purpose for which the classification is to be made. Wald described a procedure for determining the size of the critical region for any weightings (W_1 and W_2) of the two risks. The solution for the case W_1 equals W_2 is given specifically.

It is not uncommon in educational research for the predictive variables (called test scores in the foregoing discussion) as well as the criterion variable to be fundamentally qualitative in nature. The resulting prediction problem may be summarized as follows: Let N individuals, selected at random from a specified population, be distributed among a set of n_1 purely qualitative categories, and let the individuals in each of these categories be classified on the basis of past experience into two groups (e.g., passers and failers) with reference to some trait. Then let it be required to assign weights to each of the n_1 categories in such a way that the relationship between the weighted categories and the criterion trait

will be a maximum. This accomplished, the procedure can be applied to other sets of n_1 categories, and each set of categories regarded as a test in a multiple regression problem.

Wherry (54) provided a least squares solution to the problem of assigning weights to the categories of a given set so that the resulting biserial or point-biserial correlation will be a maximum. The result—weight of category must be proportional to the percentage of “passers” in the category—is extremely simple, and is one which has been employed in the past, but without the confidence that accompanies the use of a technic for which a sound theoretical basis has been established.

Consider now the case in which a given individual may belong to more than one of the n purely qualitative categories. Since an individual either does or does not belong to each of the n categories there are in all 2^n unique classes into which the individuals may be classified. Johnson (30) outlined an ingenuous time saving procedure for effecting the classification of the individuals into the 2^n classes. The members of each of the 2^n unique classes are then classified with reference to the criterion trait. A statistic is suggested which may be used as a basis for selecting from among the 2^n classes those for which the criterion classification varies significantly from what would be expected under the hypothesis that the members of the unique classes are equally distributed with reference to the criterion trait. Membership in the classes thus selected becomes the basis for prediction, and the use of a contingency table is suggested as a basis for analyzing the efficacy of the procedure.

In this connection it may be noted that Johnson (28, 29) has devised a coefficient of selectivity, which is simply the relative gain in the number properly classified with reference to the criterion trait as a result of applying the scheme described. He has also devised a coefficient of correctivity which is the proportion of misclassified individuals properly reclassified by the scheme. Both coefficients appear to have a wider application. The relation of the latter coefficient to the fourfold Pearson r is discussed in a manner which should help to clarify the interpretation of both coefficients. It is well known that the fourfold r can assume its maximal value, unity, only when the proportion succeeding on the criterion variable (P_1) equals the proportion succeeding on the predictive variable (P_2). Since the values of P_1 and P_2 are often arbitrarily set on grounds quite apart from the matter of prediction, Johnson suggested that the predictive efficiency of an application of his scheme be judged on the basis of the maximum possible efficiency attainable for the specified values of P_1 and P_2 .²

² This discussion appears particularly pertinent since much use has been made recently of the fourfold Pearson r in the development of test theory. By this use certain writers have been led to conclude that all items of a test should be made equally difficult. Given perfectly reliable items such a test would result in a dichotomous distribution of scores. It would seem more appropriate, if the fourfold coefficient (Pearsonian) must be used, to evaluate the relationship between items in terms of the maximum value of this coefficient for given values of P_1 and P_2 . Still more appropriate would be the use of the tetrachoric coefficient, which use in theoretical discussion would probably go far toward aligning theory and established practice.

As a final problem in the area of prediction consider the following:

Given a single continuous measure, x , (e.g., a test score) for each of N individuals selected at random from a specified population, and also a measure, y , either continuous or dichotomous, of the amount of some trait which past experience has shown each of these individuals to possess; let it be required to establish a critical or borderline, x_1 , which, when applied to other individuals drawn from the specified population, and for whom the y measure is not immediately available, will minimize the discrepancies between the available x score and the y score which will be ultimately attained. Solutions to both cases of this problem (y continuous and y dichotomous) have been provided by Burt (7), who pointed out that while the formulas obtained have demonstrated their value in certain theoretical discussions, they are not necessarily the most suitable, due, for one thing, to the fact that administrative conditions rarely permit the complete freedom that would be necessary to establish a borderline on the basis of the minimal discrepancy criterion alone.

Problems of Estimation and Description

Problems of estimation involve the determination of procedures for calculating sample statistics which are suitable estimates of population parameters. Problems of description involve the determination of procedures for calculating indices (descriptive statistics) which suitably describe certain characteristics of a given mass of data. Certain recent contributions in the areas of estimation and description are considered in this section.

The method of estimating the variance (σ_1^2) of a population, given the variance (s_1^2) of a random sample taken from the population, is well known. Suppose, however, that in addition to s_1^2 there is available the variance (s_2^2) of a random sample taken from another population having a variance of σ_2^2 , say, where $\sigma_2^2 \leq \sigma_1^2$. Is it possible to use s_2^2 in conjunction with s_1^2 to obtain an improved estimate of σ_1^2 ? This question is discussed by Bancroft (3), who suggests the following procedure: First, compute the F-ratio, s_1^2 to s_2^2 . If this ratio is not significant use s_1^2 and s_2^2 in the familiar formula for estimating the variance of a population given the variances of two independent random samples from this population. If the F-ratio is significant, base the estimate of σ_1^2 on s_1^2 only.

Bancroft found practically no bias to result from use of this procedure when the 20 percent level was used as the criterion for the significance of the F and when $\sigma_2^2 < 0.6 \sigma_1^2$. A positive bias is introduced when $\sigma_2^2 = \sigma_1^2$. None of the various significance levels of the F which were studied controlled the bias thruout the zero to one range of the ratio σ_2^2 to σ_1^2 , which this investigation covered. The variance of the variance estimate based on both s_1^2 and s_2^2 will usually be less than the variance of

the estimate based on s_1^2 alone. This is of little advantage, however, unless the bias is adequately controlled. Bancroft also discussed an analogous procedure for choosing between the regression equations $y = b_1x_1 + b_2x_2$ and $y' = b'_1x_1$.

Frequently in validating tests criterion measures are available, not for the whole population, but only for a group already selected for their supposed ability in the very tasks measured by the test. Suppose that the scores on a test (x) are available for individuals representative of the complete population, and that for a selected group of these individuals (i.e., selected for their supposed ability in the tasks measured by the test) scores on a criterion (y) are also available. Given these data, Brogden (5) has derived formulas for estimating for the complete population the mean and standard deviation of the criterion scores (y), and also the correlation between x and y . The basic assumptions are linearity of regression and homoscedacity. Brogden also provided an estimate of the correlation for the complete population between y and z , where z is a measure of some trait other than x and y , and like y , is available for only the selected group. The additional assumption required is an equal correlation between y and z for fixed values of x .

A more general solution to this same problem of estimation is given by Burt (7), who considered the case in which there is more than one set of test scores and more than one set of criterion measures. Burt's results are given in matrix form. In this connection it should be noted that Davis (14) has provided a formula for estimating the reliability of a test for a complete population when given (a) the reliability for a curtailed population, (b) the standard deviation of the curtailing variable in the complete population, (c) the standard deviation of the curtailing variable in the curtailed population, and (d) the correlation between the test and the curtailing variable for the curtailed population. This, of course, represents a specific application of the problem considered by Brogden and Burt. A strong word of caution against the use of these formulas in situations in which the assumptions they imply are not fulfilled is given by Burt.

Attention is next turned to moment statistics. Scates (44) presented findings of such a nature as to cast doubt upon the usefulness of β_2 (i.e., the ratio of the fourth moment about the mean to the square of the second moment about the mean—sometimes represented by α_4) as a measure of kurtosis. He showed that for weights of any given magnitude there are a pair of points (one on each side of the mean) in a normal curve at which the weights can be added without effecting β_2 . He also demonstrated that the addition of small weights in the tails of a normal distribution greatly increases β_2 , whereas large weights can be added near the mean without effecting its value. By way of comment it may be noted that $\beta_2 = 3$ is not a sufficient condition for normality, and that Scates' results are, therefore, precisely what would be expected.

Under certain conditions it may be desirable to publish the basic data of a statistical study. Pierce (39) has devised a scheme for presenting a grouped frequency distribution in such a way that the moments for the ungrouped data may be obtained from it. Pierce's scheme and the accompanying correction formulas give the exact values of the moments for the ungrouped data, and not average corrections of the type given by the usual correction formulas. Pierce aptly pointed out that, whereas the usual correction formulas provide unbiased estimates in the sense that they eliminate systematic errors due to grouping, the use of these formulas may in a given case actually make the estimate worse. A correction, based on parabolic interpolation, for grouping errors present in the second moment about zero, has been developed by Davies and Bruner (13). The formula is identical with Sheppard's at the limiting case of a continuous scale and high contact, and yet is adaptable either to an integral number of equally wide subclasses, or to a continuous scale.

By an extension of the moment concept, Rodrigues (42) has developed new measures of variability, general similarity, and overlapping. The extension is effected by writing the usual definition of the r -th moment of a variable, x_i , about the origin x_j , and then summing over j as well as i . This idea is then applied to two distributions in such a way as to yield the aggregate total moment of one distribution about the other. It is this last mentioned development which leads to the indices of general similarity and overlapping. Whether or not the indices become of practical value depends largely upon the development of tests of statistical hypotheses concerning their magnitude. Inasmuch as there is a need in educational research for statistics facilitating the study of overlap, it is to be hoped that these tests will soon be forthcoming.

Hirschman (25) has suggested that it is often required, after a dichotomous (good-bad) classification has been established, to inquire into the average "good" student, or into the variability of the "good" students. To this end, he has discussed some simple algebraic relationships between certain descriptive statistics for the subseries and those for the entire distribution. Hirschman's discussion will be of particular interest to teachers of statistics, who may obtain from it some suggestions for clarifying for their students the interpretation of the common measures of dispersion and skewness.

Statistics descriptive of the relationship between variables have been given attention by a number of writers. In considering statistical problems in test evaluation, Burt (7) discussed the problem of estimating the validity of a test (i.e., of estimating the relationship between the test scores and the criterion scores) when the criterion takes the form of a twofold or threefold classification. When interest centers primarily in the validity of the test near a borderline, Burt expressed a preference for the use of the tetrachoric coefficient over the biserial coefficient. He also provided formulas for triserial correlation and for the point-biserial coefficient.

Tables facilitating the estimation of the standard error of the tetrachoric coefficient have been worked out by Hayes (24). The accuracy of this estimated standard error is reduced as a result of the fact that the estimate is "unstudentized"; the parametric value of the tetrachoric coefficient appears in the formula for estimating its standard error. The usefulness of this standard error is limited since the exact sampling distribution of the tetrachoric coefficient is not known.

The concept of correlation as the ratio of the variation in the dependent variable which is explained by variation in the independent variable(s) to the total variation in the dependent variable is gaining considerable popularity. Perhaps the greatest advantage of this concept lies in its generality, for it may be used to define simple correlation, multiple correlation, partial correlation, curvilinear correlation, and, of course, the correlation ratio. A discussion of this concept which will be of interest to teachers of statistics has been provided by Cowden (11), who gives an interesting diagrammatic representation of the concept. The main purpose of Cowden's article is to show how this definition of correlation is basic to the Doolittle solution. Teachers of statistics may also be interested in Platt's scheme (40) for the mechanical determination of correlation coefficients and standard deviations. The usefulness of Platt's scheme for bringing out the principle that correlation is a measure of scatter from a perfect prediction line is limited by the fact that it requires of the students some knowledge of the principles of mechanics.

Two new descriptive statistics were encountered. A coefficient has been devised by Janis and Fadner (27) for the purpose of presenting an over-all estimate of the degree of imbalance, that is, the extent to which favorable, neutral, or unfavorable treatment is accorded a given topic in a given piece of writing. The coefficient is defined by joint consideration of two functions, viz., one in which favorable content dominates and one in which unfavorable content dominates, and is shown to conform to the ten criteria which Janis and Fadner regard as defining the concept of imbalance. In the final analysis, however, the validity of the coefficient depends on how well the user can form several subjective judgments, such as, defining unit of content, and classifying units of content as relevant or irrelevant, or as favorable, neutral, or unfavorable.

A new statistic for the interpretation of the validity of a test has been devised by Richardson (41). The statistic is based on a fourfold table and is in terms of a measure of the increased efficiency of the group selected by the test. The ratio (k) of the average effectiveness of the group rated successful on the criterion to the average effectiveness of the group rated unsuccessful on the criterion is required. The statistic is readily interpretable, but, as Richardson himself points out, it is limited by difficulties which may arise in estimating k .

In concluding this section attention should be called to a report by Krathwohl (32) on a method for comparing the achievement of classes with their ability. The method involved is reminiscent of certain quality

control technics. As yet little application has been found for these technics in educational research. Educational research workers ought, nevertheless, to keep informed on developments in this rapidly expanding branch of applied statistics.³

Problems of Statistical Inference in the Nonparametric Case

The most common problems of statistical inference are solved by assuming the form of the sampling distribution to be determined in a known way by certain parameters, the values of which are unknown. It is about the values of these unknown parameters that the inferences are to be made. Such problems are classified under the heading of the parametric case. This case includes all the theory based on normality assumptions (46).

However, many problems in sampling theory may be reduced to an enumeration of possible combinations and to the determination of the probability of the occurrence of certain specified combinations. The solutions of such problems are independent of the form of the population distribution function and assume only its continuity. Unfortunately when the number of observations is large the calculations involved in applying a combinatorial analysis become extremely tedious. It is sometimes possible to circumvent this difficulty by determining the asymptotic distributions of the combinations. Such problems are illustrative of the type which are classified under the heading of the nonparametric case.

Much attention has recently been given to the nonparametric case in statistical inference. Scheffé (46) provided a fifty-eight item bibliography of contributions in this area. It is not possible to describe in detail here the many nonparametric case problems which have been solved. A few solutions will be discussed briefly and others will be cited.

Consider first two solutions of the problem of two samples which may be stated as follows: Let x_1, \dots, x_m and y_1, \dots, y_n be two random samples from continuous univariate populations. It is required to test the hypothesis that the distribution functions of these populations are the same.

The first solution to be presented was originally proposed by Wald and Wolfowitz⁴ and is illustrated in a paper by Swed and Eisenhart (49). The procedure is as follows: Arrange the observations from both samples in a single series in increasing order of magnitude. In doing this attach some distinguishing character (such as an accent or prime) to the observations of the second sample. When two different kinds of objects (i.e., the observations of the first sample as distinguished from the observations of the second sample) are thus arranged in series, they will form two or more

³ A simple introduction to certain quality control technics may be had from two publications (May 1941 and April 1942) of the American Standards Association 70 E 45th St., New York. The titles in order of publication date are *Guide for Quality Control* and *Control Chart Method of Analyzing Data and Control Chart Method of Controlling Quality During Production*.

⁴ A. Wald and J. Wolfowitz, "On a Test Whether Two Samples Are from the Same Population." *Annals of Mathematical Statistics*. 11 174 62. June 1940.

distinct groups or runs of like objects. For example, in the arrangement of xxyyyxy, there are four distinct groups or runs. In this test small values of the statistic, which is simply the number of runs, are significant. Swed and Eisenhart provide tables giving the probability of obtaining a number of runs equal to or less than the number observed, under the hypothesis that the two populations involved are the same. The continuity of the population distributions is assumed. The tables are entered with the values of m , n , and u' (u' is the observed number of runs). When $m+n$ is large and the ratio m/n fixed u' is normally distributed about a readily calculable mean and variance.

The second solution to be presented was devised by Mathisen (35). The procedure may be outlined as follows: Draw a sample of size $2n+1$ and determine the median. Draw a second sample of size $2m$ and let m_1 be the number of observations in the second sample which are below the median of the first. Mathisen has obtained the probability function for m_1 . This function is independent of the population distribution function, $f(x)$, and assumes only the continuity of $f(x)$ and the independent random selection of the two samples from $f(x)$. For large samples $[m_1 - E(m_1)]/\sigma_{m_1}$ is normally distributed about zero with unit variance. Formulas are given for $E(m_1)$ and for σ_{m_1} . Mathisen also presented an analogous solution based on the quartile points. It should be noted that Bowker (4) has shown that Mathisen's tests are inconsistent⁵ when the samples are from different populations which have identical cumulative frequency distributions in the neighborhood of their medians or quartile points. If these possibilities are not admissible the tests are consistent.

The merit of these solutions to the two sample problems is that they assume only that the population distribution function is continuous and that the samples are drawn at random independently. Their weakness, of course, lies in their inefficiency in the sense that they do not make full use of the information given by the data and in their consequent lack of power. That is, a rather gross disparity between samples is necessary to yield significance. Hence when tests involving additional assumptions are plausible such tests should be used (49). Wolfowitz (55) also pointed out that the extreme generality of the hypothesis tested is a limiting factor in the general usefulness of these tests.

Wald and Wolfowitz (52) have devised an exact test for randomness in the nonparametric case which is based on the concept of serial correlation.⁶ The statistic used is not actually the serial correlation coefficient but one which results in an equivalent test. Let x_1, \dots, x_n be the observations of a sample in the order of drawing. Then the hypothesis to be tested is that x_1, \dots, x_n are independent observations from the same population.

⁵ A statistical test is called consistent if the probability of rejecting the null hypothesis when it is false approaches one as the sample number approaches infinity

⁶ A bibliography and brief review of the theory of serial correlation have also been given by Dixon (15).

The statistic used is $R = \sum_{i=1}^n x_i x_{i+h}$ where x_{i+h} is replaced by x_{i+h-n}

for all values of $i+h$ greater than n . It is necessary to choose the lag, h , on the basis of the alternatives to randomness in the situation under consideration. For example, if some sort of periodical or cyclical characteristics are suspected, h should be chosen to conform to these periods. If h

is prime to n , the distribution of $R' = \sum_{i=1}^n x_i x_{i+1}$ is the same as the dis-

tribution of R , and consequently R' may be used as the statistic in such situations. Since h can always be made prime to n by the omission of a few observations, the statistic R' is quite generally useful.

An exact test of the significance of R or R' can be effected by forming the n factorial ($n!$) permutations of the n observations and computing the R or R' for each. Since the probability of occurrence of each permutation under the hypothesis of randomness is $1/n!$, it is possible to determine the probability of obtaining a member of a specified set of values of R or R' . Wald and Wolfowitz showed that under some mild restrictions the limiting distribution of R (R') is normal with a calculable mean and variance. Provided the population distribution function is continuous the test under discussion does not depend on this function. Even this restriction of continuity may under certain conditions be unimportant in the limiting case.

Limitations on space require that other contributions to the nonparametric case be given only brief mention. Developments in the theory of runs,⁷ and its use in testing the randomness of a sample, have been reviewed by Wolfowitz (56). Illustrative applications taken primarily from the field of quality control have been provided. Articles on runs up and down have been contributed by Wolfowitz (55) and by Levine and Wolfowitz (33). Casanova (8, 9) has discussed the use of the method of runs, and also the use of a variety of other nonparametric tests, for testing the random order of the keyed responses to test items. Casanova's suggested application of these statistical tests is remindful of cutting butter with a razor. Nevertheless, workers in educational research who are interested in studying the nonparametric case may find Casanova's articles to be fairly good starting points. The solutions to several nonparametric problems are also described in an article by Wald and Wolfowitz (53), who show how a certain limiting distribution theorem may be applied to them.

Three tests based on the signs of the differences of successive observations are described by Moore and Wallis (36). These tests were designed

⁷ Wolfowitz (55) stated that runs are a matter of technique and that new advances and applications would soon render most definitions obsolete. The following definition is given by S. S. Wilks, *Mathematical Statistics*, Princeton, 1943, p. 200: "Suppose we have an arbitrary sequence of n elements, each element being one of several mutually exclusive kinds. Each sequence of elements of one kind is called a run."

for use in time series analysis but may prove to have a wider field of application.

A problem of some interest in educational research is that of determining whether an individual has matched two series of items (e.g., handwriting specimens) better than could have been done by chance. This represents an application of what has come to be called the problem of card matching. Anderson (1) has provided one of the more recent discussions of this problem. An article by Greenwood (20) on the problem of preferential matching⁸ may also be of some interest.

Thornton (50) discussed the use of Olds' tables⁹ giving the probabilities for various values of the factor Σd^2 as it appears in the rank order correlation formula. The probabilities in Olds' tables for n equals 2 thru 7 are based on possible combinations and are exact. The probabilities for larger values of n are based on asymptotic curves. Thornton pointed out a few minor errors in Olds' tables and compared levels of significance of the rank order coefficient based on Olds' tables with the levels as determined by other methods.

Other Miscellaneous Problems of Statistical Inference

Users of statistical tests have become increasingly cognizant of the restrictions implicit in the tests. The assumption of a normal population distribution has in particular drawn much attention. The use of certain transformations is a common method of circumventing this particular restriction. Curtiss (12) provided a mathematical basis for effecting square root, inverse sine, and logarithmic transformations leading to a normal distribution and a stable variance.

Another approach in overcoming this restriction would be to determine the exact sampling distributions of useful statistics for samples drawn from a population having a specified nonnormal distribution function which is plausible in the given situation. Festinger (16) provided an exact test of significance for means of samples drawn from a population having an exponential (J-shaped) distribution function. Festinger showed that the ratio of $2n$ (n is the sample number) times the sample mean to the population mean is distributed as Chi-square for $2n$ degrees of freedom. This fact makes it possible to test any exact hypothesis about the magnitude of the population mean, and to establish a critical region. Festinger has also shown that the ratio of the larger to the smaller of two sample means, based on independent random samples from an exponential population, is distributed as F for $2n_1$ and $2n_2$ degree of freedom, the n 's being the respective sample numbers. Festinger (17) has developed analogous tests

⁸ Preferential matching may be described as follows. Let the two sets of items to be matched be A_1 and B_1, \dots, A_n . A_1 is compared with each B_i , the one it most nearly matches being given a score of n , the next a score of $n-1$, etc., to 1. This procedure is repeated with each A_i .

⁹ E. G. Olds, "Distributions of Sums of Squares of Rank Differences for Small Numbers of Individuals," *Annals of Mathematical Statistics*, 9: 133-48, 1938.

for means of samples drawn from populations having Type III (skewed) distribution functions. These tests, however, are not exact, since the population variance which must be estimated from the sample enters into both the Chi-square statistic and its degrees of freedom. Moreover, it appears that the inaccuracy of the tests would be greatest in those situations in which they would otherwise be most useful, that is, when the degree of skewness present in the population distribution is marked.

Another restriction implicit in the t-test of the significance of the difference between sample means is that the ratio between the population variances (usually taken to be one) must be known. Scheffé (45) discussed a solution to the problem of two samples which is based on the t-distribution and which is applicable when the ratio of the population variances is unknown. The restriction of normal population distribution functions obtains, and the number of degrees of freedom involved is $n-1$, where n is the number of observations in the smaller sample.

The approach to analysis of variance described by Jackson¹⁰ has had increasing application. Consequently teachers and students of educational statistics will welcome Rulon's straightforward exposition (43) of the mathematics underlying this approach. Rulon dealt with the simplest case, the problem of two samples, and showed the relationship between the z-test (or F-test) and the t-test. Other articles on analysis of variance have been contributed by Grant (19) and Peters (38). Both of these articles review the earlier Garrett and Zubin article.¹¹ Grant's brief exposition of the analysis of variance technic is quite clear and may be of interest to teachers of statistical methods in education. Peters continues his practice of pointing out relationships between analysis of variance and classical methods, and of deprecating the former.

Problems arising in the application of statistical tests when the observations are in the form of percents or fractions have received the attention of Cochran (10), Baker (2), and Burr and Hobson (6). Cochran was primarily concerned with analysis of variance technics for percentages based on unequal numbers. He discussed three schemes of weighting such observations which are suitable under differing conditions and described methods of checking their efficiency in a given situation. Baker described a test of the significance of the difference between two treatments (x and y) applied to different pairs of groups in different localities, and where the effectiveness is expressed as the percent of each group that responds to the treatment. The theory of the test rests on the fact, that if the treatments are equally effective, then the percents will distribute themselves symmetrically about the line $y=x$. A transformation is effected which makes this line coincide with the x -axis, and the effectiveness of the treatments is evaluated by testing the significance of the regression

¹⁰ R. W. B. Jackson, "Applications of the Analysis of Variance and Covariance Method to Educational Problems," *Bulletin No. 11 of the Department of Educational Research*, University of Toronto, Toronto, 1940.

¹¹ H. E. Garrett and J. Zubin, "The Analysis of Variance in Psychological Research," *Psychological Bulletin*, 40: 233-67, 1943.

of y' on x' (y' and x' represent the transformed values of y and x). Burr and Hobson described a method for making a mass test of the significance of the difference between two proportions, when each pair of proportions involved is based on the same sample numbers (i.e., n_1 and n_2 are the same for all pairs but n_1 need not equal n_2). In addition to the usual assumptions involved in testing the significance of the difference between two proportions, it is necessary to take cognizance of the fact that if one hundred pairs of differences are tested and if the 5 percent level of significance is adopted, then the expected number of significant differences under the null hypothesis is five.

Simon (47, 48) discussed the situation in which the risk of making an error of the first type (rejecting a true hypothesis) equals the risk of making an error of the second type (retaining a false hypothesis).¹² Simon referred to tests suitable in such a situation as symmetric tests and showed in the case of the two sample problems that the uniformly most powerful symmetric test of the hypothesis that the mean of population y is greater than the mean of population x is simply that $\bar{y} > \bar{x}$. The test assumes that the population distribution functions are normal and have equal variances, and requires the sample numbers to be equal.

A simple but crude test of the hypothetical magnitude (H) of a population mean is described by Knudsen (31). The statistic is simply $(H - \bar{x}) / \text{Range}$. The 5 percent and 1 percent critical points for this statistic are tabulated for sample numbers from 3 thru 30 and for 40, 60, 120, and 500.

Gumbel (22) discussed the lack of reliability of the Chi-square test of goodness of fit of an observed distribution of a continuous variate. He pointed out that two equally competent statisticians working with the same data might be led to adopt different conclusions on the basis of this test as a result of (a) making different choices of intervals, (b) adopting different starting points for the first interval, and (c) following different procedures of combining end intervals to increase the expected frequencies for these intervals. Gumbel also pointed out that the effects of combining end intervals (i.e., a reduction in the magnitude of Chi-square and reduction in the degrees of freedom), while counteracting, are not necessarily equally potent, and that this practice, moreover, violates the postulate that all intervals be of the same magnitude.

Grubbs (21) has shown that the sampling distribution of the radial standard deviation is the Chi-square distribution for $2n-2$ degrees of freedom. The radial standard deviation, which has not as yet been applied in educational research, is used in ballistics to measure the accuracy of

rifle fire. It is defined as $Z = \left[\frac{1}{n} \sum (x_i - \bar{x})^2 + \frac{1}{n} \sum (y_i - \bar{y})^2 \right]^{\frac{1}{2}}$

where x_i and y_i are the abscissa and ordinate the i -th point measured from an arbitrary origin, and where n is the number of points. The derivation

¹² See also the article by Wald (51) reviewed in the section on problems of prediction.

of the sampling distribution cited assumes that the variance of the x -population equals the variance of the y -population.

It is frequently desired to determine values of Chi-square or of t which have not been tabled. Peiser (37) has developed simple formulas for approximating values of Chi-square and t for any given number of degrees of freedom and for any given percent point. These formulas may also be used to approximate the percent points corresponding to obtained values of Chi-square or t given the number of degrees of freedom.

Only two studies dealing with problems of sampling will be cited. Hansen and Hurwitz (23) have written an article covering, in a rather comprehensive fashion, developments in the theory of sampling from finite populations. Their discussion covered problems of subsampling and of estimation in various subsampling systems. Madow and Madow (34) discussed the problem of systematic sampling (i.e., a sample picked by choosing a starting point and then selecting every k -th element until the desired number of elements is obtained) and of estimation based upon such samples.

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CHAPTER VIII

Computational Technics

IRVING LORGE

MANY of the more significant developments in computational technic overlap basic contributions to statistical theory. It is difficult, indeed, to make clear cut distinctions between computational processes and statistical innovations. Some of the studies reviewed, therefore, must illustrate both theoretical and computational processes. During the past three years, the articles showing computational development deal primarily with the utilization of machines (particularly those of the International Business Machines Corporation) for mass processing of data, with methods for solving simultaneous equations, with methods of using analysis of variance, and with simplifications and extensions of factor methods. It must be recognized, however, that many contributions to mass methods of handling data developed or extended by the armed services may not be reviewed at present since these methods are classified as "restricted" or "confidential." There is good reason, however, to believe that in the next three years the computational methods developed in the armed services will become available to the research worker.

General

Most significant is the appearance of a quarterly journal, *Mathematical Tables and Other Aids to Computation* (2). The new journal is a clearing-house for information about mathematical tables as they are developed, errors in published tables, and machine aids to computation. The educational researcher should be particularly interested in tables reviewed by Committee K and in the explanation of recent developments in calculating machines and in mechanical computation by Committee Z. In recent issues the following references to Recent Mathematical Tables should be helpful (2:91, April 1943; 2:101, July 1943; 2:108, 109, 110, 111, 112, October 1943; 2:129, 130, January 1944; and 2:164, October 1944).

For those who use the various machines of the International Business Machines Corporation, the *Pointers* frequently give illustrations for adapting the machines to various statistical computational processes (25). The *Pointers* are particularly rich in applications adapted to the tabulator and the multiplier. Frame (16) described devices for solving algebraic equations covering graphics, kinematic linkage, dynamic balances, hydrostatic balances, electric and electromagnetic adaptations, harmonic analyzers, and calculating machines.

Tables, Graphs, and Nomograms

In addition to the tables cited in *Mathematical Tables and Other Aids to Computation* (2), Hayes (19) has prepared tables of the standard error of the tetrachoric correlation coefficient for argument from .00 to

.90 in steps of .10 and for .95 with cuts at 50, 30.9, 15.9, 5.48, 2.28 and 0.466 percent. Anderson and Houseman (1) have developed tables which will greatly facilitate polynomial curve fitting. Casanova (8) has developed tables and charts for weighting subtests into a general sum where the weights are functions of test length and reliability.

Recent nomographs and graphs are those developed by Bliss (5) on the chi-square distribution, by Lord (33) for computing the fourfold point biserial correlation, by Paschal (35) for solving partial correlation problems, and by Jurgensen (29) for obtaining centiles.

Tabulating Machines

Benjamin (3), utilizing the method of "counter rolling" on the I.B.M. tabulator (in the absence of card cycle total transfer), has developed a procedure for computing the sums of squares and cross products without the use of summary punching or manual addition. Unfortunately, the method is not practical beyond two variable problems. Bloom and Lubin (6) showed how the graphic item counter of the I.B.M. test scoring machine may be used to obtain Pearson Product-Moment correlation coefficients. Grossman (17) illustrated how the test scoring machine may be used to obtain weighted scores. He adapted the line length of the test scoring blank to weight the scores.

A significant study of errors in card punching was made in the Bureau of the Census. Deming, Tepping, and Geoffrey (10) analyzed 25,000 wrongly punched cards. Of the erroneous cards 86 percent had only one mistake, 9 percent had two mistakes, and 5 percent had three or more mistakes. The mistakes were classified as machine errors (failure to skip) and operator errors (failing to include a field, repeating a field, interchange of numbers, etc.). Operator errors predominate in perseveration of usual or majority punching i.e., the operator tends to use the more frequent punches in cards where a typical or unusual punching is required. Deming and his co-workers, however, indicated that errors tend to compensate.

Much of the material deals with the use of tabulating machines for the preparation of tables. Herget and Clemence (20) suggested the use of modified second order or higher differences to reduce the labor of preparing linearly interpolable tables. Extending this idea, Miller (34) pointed to a further generalization which reduced the amount of work in table preparation. King (30) described his method of tabling exponential functions; Thomas and King (42), a method of tabling logarithms; Knudsen (31), a method of obtaining the coefficients for orthogonal polynomials which requires 20 percent of the time needed in Warren's technic; Kormes (32) discussed a method applicable to the I.B.M. and Remington-Rand machines for obtaining numerical solutions of finite difference equations.

Watkins (46) illustrated coding technics to increase the speed and efficiency of class and school record keeping.

Simultaneous Equations

Much work has been published giving the logic and process of matrix calculation. An extraordinarily useful exposition was that of Hotelling (23, 24) who gave modern methods of solving linear equations, determinants and inverses of matrices. Special attention was given to iterative methods and to means for accelerating convergences. Hotelling showed the importance of considering the rounding out of errors in computing. Tuckerman (45) suggested that each unknown be found in the form $x(1 \pm E)$ to estimate the computational uncertainty. Dwyer has continued his significant publications on the value of the "abbreviated Doolittle." He reviewed the methods of solution of problems of multiple and partial correlation and regression with indications of solutions or related equations and identification of related statistics (13) together with a bibliography of thirty-seven titles on related work. The validity and value of the "abbreviated Doolittle" (14, 15) and the ease of the compact solution (11, 15) were treated adequately.

Hoel (21) showed the essential identity of standard routines for computing the inverse of the matrix; Samuelson (36, 37) developed a more efficient method for determining the coefficients of the characteristic equation. In addition Spoerl (41) and Bingham (4) also gave procedures for solving the matrix. Jackson (26) discussed several methods for obtaining approximate multiple regression weights, and Sandomire (38) gave a table of factors to obtain successive cumulative sums without intermediate recording.

Dwyer (12) discussed grouping errors and suggested methods adaptable to the I.B.M. tabulator to reduce these errors. Day and Sandomire (9) illustrated the use of Fisher's discriminant function to distinguish among more than two groups.

Analysis of Variance

The fundamental principles underlying analysis of variance designs, their construction, and their numerical solution were given by Satterthwaite (39). Johnson and Tsao (28) applied analysis of variance in a problem of the estimation of differential limen values giving complete analysis of a $4 \times 7 \times 2 \times 2 \times 2$ pattern, and to a problem in the study of individual educational development (27) giving complete analysis of a $2 \times 3 \times 3 \times 3$ pattern. Butsch (7) has developed a work sheet, using logarithms, for the Johnson-Neyman method, and Schultz (40) has adapted analysis of variance technics to ranked data.

Factor Analysis

Thurstone has developed a new factor analysis method and gives the computational procedure for estimating a factor matrix eliminating the necessity for calculating successive residual matrices (43). Essentially, the

method yields clusters of test vectors and in reality is a multiple group method of factoring the matrix. Holzinger (22), too, has developed a simple factor method based on the idea of substructuring the matrix. Tucker (44), using the method of bordering the original correlation matrix with a new row and column for each component, developed a computational procedure that eliminated the labor of obtaining residuals. An interesting adaptation of Tucker's basic procedure to the I.B.M. tabulator and calculating machines (19) showed that factor analysis can be adapted to mass methods efficiently and accurately. The study gave a complete example together with wiring diagrams, forms, and calculations.

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- * **Ayres, Leonard P.**, Vicepresident, Cleveland Trust Company, Cleveland, Ohio.
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¹ Corrected to January 1, 1946 Report errors immediately to the Secretary Treasurer

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† Elected to membership beginning January 1, 1946.

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